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This report contains information on national-level science policies, technology strategies, and research and development programs in West European science and technology in general and specifically in civil technology, with particular attention to transportation, energy, chemical manufacturing, industrial automation and technology transfer. The report will focus primarily on France and the Federal Republic of Germany, but will also cover important developments in Italy, the Netherlands, Sweden and other West European countries.

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SCIENCE AND TECHNOLOGY

No. 8

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FRANCO-GERMAN SATELLITE SYSTEM PLANNED

Paris AFP SCIENCES in French 4 Oct 79 pp 12-13

[Text] Mr Armin Gruenewald, spokesman for the West German Government, announced in Bonn on 2 October that Paris and Bonn have agreed to launch two "pilot" telecommunication satellites by 1983.

The construction of those satellites will be handled jointly by France and the FRG, each producing one.

This Franco-German telecommunication satellite system project for direct transmissions of telecasts provided one of the prominent items for the first day of the Bonn summit, which brought President Valery Giscard d'Estaing and German Chancellor Helmut Schmidt together on 1 October.

The French chief of state emphasized that in this area "the prospects of a world market are unquestionably important" and judged it to be "desirable that French and German industry proceed in coordinated fashion."

Giscard d'Estaing added that "the national consequences of applying such technology should be examined very carefully by competent government officials or those in a position to contribute to the deliberations."

According to details announced in Paris by the TDF (Telediffusion de France) about this agreement a certain preeminence will be granted to the FRG during the study and development phase, with a German company as overall manager of the project. According to Jean Autin of the TDF, the FRG would finance 54 percent of the cost against 46 percent for France. Later on the construction of the satellites in orbit (one operational and one as standby ready to operate) and their replacements on the ground would allow the reestablishment of equality of the two countries in an industrial and commercial organization capable of exporting the technology as well.

As per agreement, the prime contract management for the platforms will be largely German and that for the payload (the television transmitters) largely French. The average service life of a satellite is estimated at close to 10 years so periodic launches will have to be made to keep the system in operation.

The TDP indicates that placement of the satellites at 36,000 km altitude above the equator, at a longitude of 19°W, will assure complete coverage of metropolitan France without any nonilluminated zone. The use of an amplifier onboard is sufficient to assure immediate and total coverage of a territory.

The employment of classic terrestrial methods implies in effect the construction of 110 emission centers for all of France, complemented by 2000 relay transmitters for each program. This technical aspect of the television by satellite system permits concentration on its economy.

The cost of a production model satellite is around 290 million francs--70 million francs for fabrication and 220 million francs for launching--according to the TDF. The overall cost of the initial study and development phase (including the launching of the first satellite for each of the two countries) is being estimated at around 1.3 billion francs divided between France and the FRG.

For the individual viewer direct satellite television will require the purchase of a parabolic antenna at a cost of about 2000 francs including installation.

The system, which will not become operational before the year 1985, will permit the TDF for the first time to use three channels, two of them serving for duplication of terrestrial networks of programming by the TF1 and Antenna 2 companies, with the third channel available for new programs "whose nature has not yet been determined."

Finally, the effect of all these new techniques will be to limit the range of the state monopoly held by the TDF. Programs originating in other countries will to a large extent "overlap" onto French territoriy and the other way around, with such overlapping anticipated by a convention on the redistribution of frequencies among different countries, signed at Geneva in 1977.

9291
CSO: 3102

IEA PLANS SOLAR ENERGY INSTALLATIONS IN SPAIN

Paris SEMAINE DE L'ENERGIE in French 27 Sep 79 p 12

[Text] The International Energy Agency (IEA) announced awards of several contracts for the final design and construction of two experimental solar-electric powerplants with a capacity of 500 kW, which will be installed and operated near Almeria in the south of Spain. The project is the result of collaboration between the eight member countries of the IEA: Germany, Austria, Belgium, the U.S.A., Spain, Greece, Sweden, and Switzerland. The first construction contract for a powerplant with a "central collector," valued at the total sum of 26 million DM, has been awarded to the German company Interatom. The second contract, valued at more than 22 million DM and calling for the construction of a powerplant with "distributed collectors," was awarded to a group including the American Acurex company, the German MAN and the Spanish Technicas Reunidas companies.

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CSO: 3102

ESA CHOOSES FIRMS FOR SPACE VEHICLE PROJECT

Paris AFP SCIENCES in French 4 Oct 79 p 15

[Text] The German firm DORNIER SYSTEM was chosen as prime contractor by the European Space Agency (ESA) for production of the space vehicle, which will participate in the international solar polar mission (ISPM). This mission, to be conducted in cooperation with the American NASA which in turn will have the responsibility for furnishing a second space vehicle, will have for its objective observations of the sun by means of two vehicles or solar probes. Each will gravitate through polar solar orbits, one to the north and one to the south in relation to the solar equator.

The DORNIER SYSTEM company heads the industrial group STAR. The contract, which will be awarded to DORNIER, is for a total amount of around $57 million or 240 million francs and includes the design, development, fabrication and tests of 47,180 f million currency units (MUC).

The associated contractors on this project are THOMSEN-CSF/SEP (European Propulsion Society) (France), FIAT-MONTEDEL (Italy), FOKKER (Netherlands), SENER (Spain), LM ERICSSON (Sweden), CONTRAVES (Switzerland) and BADG (Great Britain).

The two space vehicles of the ESA and NASA will be launched linked to each other in February 1983, by a space delivery system, including the American space shuttle, to which an inertial upper stage (IUS) will be attached for that mission.

About 4 years after their launching the two probes will reach their objective of circling the poles of the sun at an altitude of about 225 million km.

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CSO: 3102

EUROPE-WIDE EFFORT IN TELECOMMUNICATIONS CONSIDERED

Paris LE FIGARO in French 8 Oct 79 p 8

[Article by Jean Lecerf]

[Text] Last week at Villers-le-Temple the European Commission discussed particularly a proposal for united action by the nine member countries, to catch up with our backwardness in the industries of information processing and automation.

The European market effectively represents an important share of the world market. It is larger than our share in the production of these installations using highly advanced technology. In telecommunications we provide about 30 percent of world production and our market furnishes about one-third of the customers. In information processing equipment we provide 29 percent of the market and produce 10 percent. The European share is on the increase, thanks to national programs, but a growing part of the business volume includes hardware designed somewhere else.

The top computer company in Europe is French but its size is only one-twentieth that of IBM. Europe is falling behind in large computers and even in the area in which it holds the best position: peripheral equipment for data processing. Logic equipment and telecommunications are strong points but the worrisome factor are electronic components which enter more and more into the composition of all modern capital goods, from automobiles to electrical household appliances. The world market is on the order of $6 billion and is estimated at $80 billion for 1990. We use one-quarter of the world production because these are areas in which Europeans are well situated, but we contribute only 10 percent of world production. It is the Americans and the Japanese who dominate that market and there is concern lest control be progressively extended to those sectors in which electronic components play a decisive role.

These facts were brought to light by Etienne Davignon, in charge of industrial policy at the European Commission, particularly during last week's presentation of "data processing and society." According to him there are basic reasons for this backwardness. Europeans work in markets that are too narrow and too divided by national preferences, particularly in the public sector, by different national standards and by national monopolies in telecommunication. Those "little national markets don't, for the most part, offer a sufficiently large production base for big exports."

What is the proposed remedy? The formation of a subtly unified market within the European Community, which will be open to the outside.

For instance, international standards can be adopted but a common front presented in their design, to protect our interests. In a subtle external business policy we can encourage what we don't manufacture but protect a fledgling European industry. A concerted policy of orders from the public sector must be maintained and an element of subtle European preference introduced when it beomces a question of large infrastructures and of new products and services.

At the moment an entire group of propositions is being studied. They do not foresee complete Europeanization for everything but to work at the level of joint action whenever opportunities for development and generation of employment would otherwise be lost.

Industries using advanced technology require large markets.

9291
CSO: 3102

FIREPROOF CABLE EVALUATED; MAJOR MANUFACTURERS RATED

Graefelfing ENERGIE in German Nos 8/9, Aug/Sep 79 pp 303-307

[Unsigned article: "What Does 'Fireproof' Mean? A Flareup of Discussion About 'Fireproof' Cables"]

> [Text] Are they fireproof, fire-resistant, nonflammable, temperature-stable? What characteristics must they have? What standard should they comply with? Who supplies them? There is smoldering discussion of these open questions regarding temperature-stable electrical leads. There is a want of determination to create clear specifications.

During the Hanover Fair in April of this year it was mostly the small cable manufacturers who competed with exotic new developments: fireproof cables (whatever "fireproof" may mean) to be fabricated as required. Among the large firms in this field information was given out at best sotto voce; the subject seems to be a hot one. One obtains the same impression when on 17 July 1979 demonstration tests with fireproof cables were carried out in the Otto Graf Institute of the University of Stuttgart. Sponsors of the demonstrations were the Baden TUeV with the guests coming from various TUeVs [Technical Monitoring Administrations] and EVU's [Electricity Supply Companies]. The press was excluded. One would hardly suspect headlines to be lurking behind this topic. ENERGIE asked Prof Dr Gerhard Wanser of the Technical University of Hanover for a statement: What is the discussion about; what are "fireproof" cables? The answer of the professor couched in layman's language was: "In addition to delayed ignition and slower fire propagation the so-called fire-resistant cables should also maintain their operational reliability during a fire throughout more or less extended periods of time. Besides having this characteristic during a fire these cables have the merit that halide-free materials are used for the insulation and the sheathing. Halide-free, fire-resistant cables, as is well known, are characterized by low smoke production in a fire. This undoubted advantage of such cables must, however, be purchased at the price of concessions with regard to the mechanical and electrical properties of these materials. In my opinion the manufacturers have not sufficiently emphasized that these fire-resistant cables are certainly of interest for power plants and also for special applications; for normal electric power

supply operation the reliability of conventional types of cable is entirely adequate."

Fire tests with cables performed by the Baden TUeV [Federal Republic of Germany Automobile Inspection] have shown that by means of a new sheathing material fire propagation is reduced. In the right-hand illustration (new cable material) after 7 minutes of burning time the fire has been almost extinguished; in the left-hand figure after the same period of time the burning of a conventional cable is almost undiminished.

According to Wanser's evaluation the discussion of these cables may be outlined in just a few points:

i. Concomitant phenomena in cable fires could be

a. the development of aggressive gases having corrosive and toxic effects,

b. further propagation of the fire,

c. failure of the cable system,

d. the danger of panic when there is intense smoke production.

ii. Areas of application for fireproof cables are

a. buildings and facilities having a high concentration of valuable property,

b. facilities in which the cost of operational interruptions is high,

c. facilities with high safety requirements.

iii. Fireproof cables have no usefulness in the case of

a. cables for power transmission; here there are technically and economically better ways of securing fire protection; the Association of Property Insurers has issued a memorandum on this subject; in addition experience has shown that when cables are properly placed they burn only in the presence of a self-sustaining primary fire [Stuetzfeuer]; moreover, fire tests have shown that in the absence of airflows and with horizontally laid cables there is practically no propagation of the fire beyond the area of the primary fire; vertically laid cables burn only when between the individual cables there are fairly large intermediate spaces in which a chimney effect is possible;

b. these statements regarding the propagation of fires apply for the most part to PVC cables and are less applicable to VPE and PE cables.

iv. The specifications applicable to fireproof cables are therefore

a. no fire propagation,

b. no corrosive or toxic fission products,

c. little smoke development,

d. functional reliability over an adequate period of time.

Even before the question of temperature stability is dealt with the discussion turns upon clarifying the issues. Wanser: "There have been fires in power plants and also in other facilities in which secondary damage resulted. These losses were overestimated and this led to such exaggerated generalizations that people were ready to demand that every type of cable should be fireproof and halide-free. In so doing they entirely overlooked the fact that individual forms of damage were involved which could have no relation whatever to the totality of facilities or to the operational security of such facilities."

These indications that the subject of fireproof cables is smoldering underground also proceeds from the behavior of the official agencies themselves. Power plant architects and cable manufacturers have adopted similar positions and have stated to their common client, the EVU, what could be done in the interest of more cable safety. The TUV had held back and had obviously only intervened when there was fear that developments might arise which might not be properly controllable by the official apostles of safety. The TUV people wanted to keep command of the situation and reran the cable discussion. At the same time the cable manufacturers were also looking for a partner. The VDE [Association of German Engineers] was brought in; which displeased a number of TUV people, and now we have reached a situation in which a lot of cooks are cooking; let us hope that the porridge will not be spoiled.

Engineer Klaus Schwamborn, colleague of HEW /Hamburg Electricity Works/ Kabel's /Cables/ Heinz Eilentropp KG in Wipperfuerth, summarizes it this

way: "There exists the danger, if we let these things run out of control, that all of a sudden requirements may be formulated by a third party and we may be obliged to assert that these requirements do not meet the intended purpose." The final effect of the breakdown in Harrisburg has been that now cable specifications are being set up without sufficient thought being given to their logic.

Heinz Eilentropp, manager of the HEW Kabel plant in which copper and aluminum leads are sheathed, has summarized what must be involved today when we talk about "temperature-stable leads." He formulates it this way:

i. What are temperature-stable leads?

a. In choosing levels of performance for higher temperatures the questions which are decisive in selecting materials are questions relating to peak temperature, steady-state temperature, usability (read "working life") under operational conditions and other influences.

b. Temperature-stable leads are used whenever the temperature conditions and operational conditions do not permit the use of traditional leads.

c. The operational temperature lies above 120° C for a generally accepted life expectation of at least 25,000 operational hours.

d. For a life expectation of from 35 to 40 years the threshold should be at about 60° C.

ii. Available materials are

a. carbon fluorides like PTFE, PFA, FEP, ETFE,

b. hot-vulcanized silicone rubber,

c. elastomeric fluorides,

d. mixtures of various materials.

iii. A broad area of application is the energy field:

a. In the conventional power plant: in the MSR domain carbon fluorides mainly; power supply leads sheathed in silicone rubber; turbine generator firing facilities; carbon fluoride leads for MSR and power supply partially sheathed in silicone rubber.

b. Nuclear power plants: the conventional portion as previously; safety vessels: combinations of carbon fluoride, ETFE and silicone rubber as well as pure silicone rubber leads; turbine generators: MSR technique carbon fluoride leads; present designs have features such as AS [design breakdown] safety (previously GAU), long-term usability with regard to temperature stress and radiation stress and climate in the safety vessel, low smoke development, toxicity, functional readiness after AS as well as acceptable ways of manipulating these leads in laying them and during possible decontamination.

iv. What does the TUeV require?

a. In 1976, while representing the Stuttgart TUeV and the Stuttgart state government, the Baden TUeV presented a draft proposal which for the first time specifies for a specific project and with a view to the future the cabling of a nuclear power plant in subsequent facilities.

b. The principal constituent of this specification is behavior in fire: fire propagation, absence of halides, smoke development, fire stress, functional readiness.

c. Further criteria are: mechanical, electrical values; preaging; AS investigations; radiological investigations; resistance to boric acid.

d. A primary problem was the establishment of a universally satisfactory testing method; the essential characteristics of the IEEE crucible were combined with those of the Sweden oven and the specifications of DIN 4102.

e. The halide content is derived by element analyses.

f. The corrosiveness is derived by means of pyrolysis and the change in the pH of distilled water.

What Is the Present State of Development?

In order to comply with the requirements of the TUeV and other authorities the cable industry has modified unsuitable materials in order to improve their fire behavior with regard to self-extinction and fire propagation in the absence of halides. Since fluorine, bromine and iodine are also halogens tests are being conducted to determine whether fluorine may be compared with other halogens with respect to corrosiveness since there are individual applications in nuclear power plants in which this material is indispensable.

After the conclusion of the first phase (accidental fire) of the tests conducted in 1979 silicone rubber has been prescribed as the sheathing material for temperature-stable leads (temperature greater than 120° C/25,000 hours and greater than 60° C/40 years). This material has a high reserve for the desired operational life of 40 years with respect to temperature stress.

Lead designs for control leads and power supply leads have silicone rubber or silicone rubber sheathing as core lead insulation.

Shielded control leads and power supply leads such as leads for industrial electronics with static or woven shielding should have a protective foil over the stranded cable in order to protect the core lead insulation against the shielding mechanically.

With reference to fire behavior it is advisable and practicable to use foil material on a basis of a compound of fiberglass and mica or on asbestos paper. It is true that the asbestos paper is mechanically equivalent and is handled more easily; however, over the long term its use might have undesired consequences because it is hygroscopic.

The fire propagation was so substantially diminished that the primary fire had already been extinguished after half the test time.

Smoke development varies depending upon the individual materials; even for the same material there can be differences depending upon the design of the leads.

The quantity of material available during the first ignition phase is apparently decisive in determining smoke density; it is greatest at this time and becomes progressively less as the fire increases.

Design features such as thin-walled insulating shells and insulating sheathing as well as static screens reduce the development of smoke.

Discussion continues unabated. It is still not possible for anyone to say definitively exactly what requirements temperature-stable leads must meet, by what examining procedures they are to be tested or how individual cable types are to be compared with one another. What exists, in Eilentropp's view consists "in part of overambitious goals and an enormous amount of data--creating the danger of impeding further development only because they are not being intelligently managed."

As long as data are still being collected by means of cables designed for specific application--meaning not only for power plants but also quite generally--no specifications should be established which are designed only for a specific material. The testing methods should be such as to make it possible by their means to compare any cable in terms of its values. To measure resistance, says Wanser, "is a rather simple matter, but in conjunction with behavior in the presence of a fire it becomes more difficult."

The energy industry is interested in the problem of designing its operational facilities on a level of maximum reliability--of this Wanser is certain just as he believes that at the present moment the EVU will be in an insecure position if undefined qualitative and quantitative requirements are imposed on the operating facilities under discussion. Also there exists the permanent risk that a third party may set up requirements having a logic which can persuade no one.

Wanser's recommendation is clear: the specifications for these special cables must be defined in the same way in which today we define testing procedures in the VDE specifications. One should have the courage to finally draft such specifications without at the same time impeding technical development, i.e., from time to time one must repeatedly adapt these specifications to the most recent state of knowledge.

Cable Manufacturers Offer a Nonuniform Product

That it is necessary to set up a system of labeling is indicated by a questionnaire circulated by ENERGIE among the cable manufacturers.

The questions were always the same:

1. Designation and type of flame-resistant cables being offered;

2. Area of applicability of the offered cables;

3. Properties of the cables:

a. electrical properties,

b. mechanical properties;

4. Construction of the cables;

5. What insulating materials are employed: Teflon, mineral materials or other materials?

6. Fireproof fittings;

7. Areas of use;

8. Temperature stability;

9. Reference installations;

10. Prices.

The answers to this questionnaire (most of the companies gave none) are definitely not such as to make it possible to compare the cables offered. To

be sure, this is also a consequence of the fact that the questions asked were very general, but it is difficult to see how questions could be precise when sales arguments still take the place of facts.

Ehlerskabel

The Friedrich C. Ehlers cable plant requests understanding of the fact that questions 4 and 5 were not answered. Regarding question 8 the Hamburg cable manufacturers wish to add the further amplification "that the temperature stability is determined by the construction and design of the cable so that here it is generally possible only to give limiting values." This applies to question 10 for, says Ehlerskabel, "the multiplicity of requirements gives rise to a very broad spectrum of product offering which it has not yet been possible to incorporate into the price lists."

1. Elopyrodur safety cable;

2. 500-v to 6/10-kv operating voltage;

3. Capable of operating under the action of fire and halide-free:

a/b. Satisfy at least the relevant VDE specifications;

4. --

5. --

6. Still in the development stage;

7. Operating sites exposed to the risk of fire and explosion; high temperature fabrications; high-value installations such as data processing; electrical facilities serving safety functions; alarm installations;

8. Up to about 800° C and capable of functioning up to 180 minutes;

9. The Frankfurt subway;

10. --

Felten and Guilleaume Carlswerk, Company

1. Fire-resistant, halide-free high-voltage cable and high-voltage lines;

2. 1-kv cable based upon the VDE specification 0271;

3. Electrical and mechanical properties in accordance with VDE 0271 in addition to function testing under the action of fire in accordance with VDE 0472, Part 814, or IEC 331 and leakage current testing;

4. Conductor insulation of special elastomers or reticulated polyethylene; flame-resistant winding of mineral or inorganic fabrics as a heat shield; common core sheathing wound or extruded; shielding as concentric stranded sheathing; outer covering of reticulated copolymers;

5. --

6. --

7. Containment in nuclear power plants; subways; skyscrapers, public buildings, hospitals; marine cables and ship's cables;

8-10. --

Monette

IEEE 383, VDE 0472 (under more stringent conditions), IEC 331: the Monette Company has subjected its "Moflam" cable series to all these tests in order to evaluate flame-resistant leads. Successfully, according to the manufacturer who is also able to produce VDE expert testimony to establish that the testing has been carried out in accordance with the IEC publication 331 dated 1970. For the installation leads of "Moflam" type with PVC outer sheathing (3 · 1.5 mm^2e and 5 · 1.5 mm) it was attested that the submitted test samples displayed no voltage interruption during the entire test period. For 3 hours an 800° C flame burned beneath the cable but there was no change in voltage.

In the standard design the cables consist of three or five massive conductors ranging from 0.75 to 2.5 mm^2; the Marburg plant is prepared to manufacture special designs. The primary insulation of the individual conductors consists of silicone rubber over which there is applied a fireproof homogeneous asbestos pressed sheathing, according to Monette; the sheathing material is said to be flame-resistant PVC or silicone rubber or flame-resistant polyurethane.

HEW-Kabel, Wipperfuerth

1. Our flame-resistant leads bear the designation: FRNC-HEW-Kabel; type: 77 SiHSi or 757 SiHCSi or 757 SiH (St) Si with FRNC standing for "flame-retarded noncorrosive." These leads are both shielded and unshielded hose lines and leads for industrial electronics in the high-temperature domain.

2. The hose lines encompass the domain of all commercially conventional core numbers and cross sections such as, for example, 60 x 2.5 mm^2 or 4 x 50 mm^2. The maximum possible outer diameter is about 50 mm. The leads for industrial electronics stranded pairwise or bundle-stranded can also be manufactured up to the previously mentioned outer diameter. The operating voltage has a maximum value of 1 kv.

3. The electrical properties correspond to conventional silicone qualities or to the VDE values required for this type of lead. The same applies to the mechanical values of the core insulations. With respect to sheathing qualities the improvement in flame resistance has resulted in slight loss of tearing strength. But an intentionally introduced improvement in resistance to tear enlargement compensates this loss. In any case the required VDE values are attained.

4. The construction of the leads and also wall strengths and colors follow VDE specifications. Unshielded hose lines contain no additional foil or filler. Shielded leads are provided with an inorganic foil over the stranded cable.

5. For high-temperature FRNC types we employ hot vulcanized silicone rubber.

6. Silicone leads are in most cases cabled in boxes. In a few cases junctions are produced using cold vulcanized silicone rubber. Flame-resistant housings are available today.

7-8. The field of application is the domain of high temperature up to 180° C or for nuclear power plants in the domain of safety vessels in an AS-resistant design.

9. For this FRNC lead type there still does not exist any reference installation since the designs were first carried out for KKP II. Leads constructed in accordance with previous design, carbon fluoride insulated cores and silicone sheathings were installed for AS systems in the following facilities: Brunsbuettel, Unterweser, IRAN 1+2, Goesgen, Isar, Tullnerfeld, Grafenrheinfeld, Wuergassen. Expert opinions for these leads were provided by the VDE and TUV. For the FRNC types the expert certifications have not yet been concluded.

10. As compared with designs on an XLPE/VDE/EDR base are higher by a factor of 3-7.

SEL

The event which brought the Muelheim-Kaerlich nuclear power plant into the headlines recently was the breakdown in the American Three-Mile-Island nuclear power plant. The construction of the two power plants was compared. Since then it has become clear even to opponents of nuclear power that these two power plants differ; they are also different in a respect which hitherto has been little discussed: the Muelheim-Kaerlich nuclear power plant will have cables which can claim plus-points for itself with respect to fire safety--and this fact is putting Lorenz Standard Electric Company (SEL) into the headlines. The ITT daughter already has "collected works" to offer to interested persons. A writeup gives information regarding cable details and TUV tests (regarding point 1); design drawings are available (point 4);

"Cable Fittings for Nuclear Power Plants" is the title of a brochure which gives detailed information regarding point 6.

1. The halide-free fire-resistant cables are introduced into their sales program by SEL as "Rhenohal" cables. Hitherto the following types of cable were furnished: heavy-voltage cable 1 kv, type 2X3GX; heavy-voltage cable 10 kv, type 2XHS3GX; control cable 1 kv, type 2X3GX; cables for transmission technology, type RD-2X(St)3GX.

2. High-voltage cable 1 kv, 2X3GX (4 x 1.5 mm^2--4 x 120 mm^2); high-voltage cable 10 kv, 2XHS3GX (1 x 240 mm^2); control cable 1 kv, 2X3GX (3 x 1.5 mm^2--40 x 2.5 mm^2); cables for transmission technology, RD-2X(St)3GX (2 x 2 x 0.5 mm^2--96 x 2 x 0.5 mm^2).

3a, b. Corresponds to the particular VDE specifications 0271 and 0815 and in addition are associated with: no fire propagation under the action of a primary fire; no fire damage resulting from corrosive products of decomposition; low fire stress imposed upon exposed insulating and sheating materials; long-term functional preservation of the cable during a fire; capacity to support excess thermal stress; radiation stability up to 2° 10^8 rad.

4. Request documentation.

5. Insulating materials: reticulated flame-resistant special polyethylene flame-protective elements; to secure a good barrier effect against the action of an open flame the following elements are employed: fleece flame protection, fabric flame protection, filler flame protection, sheathing, reticulated flame-resistant special elastomers.

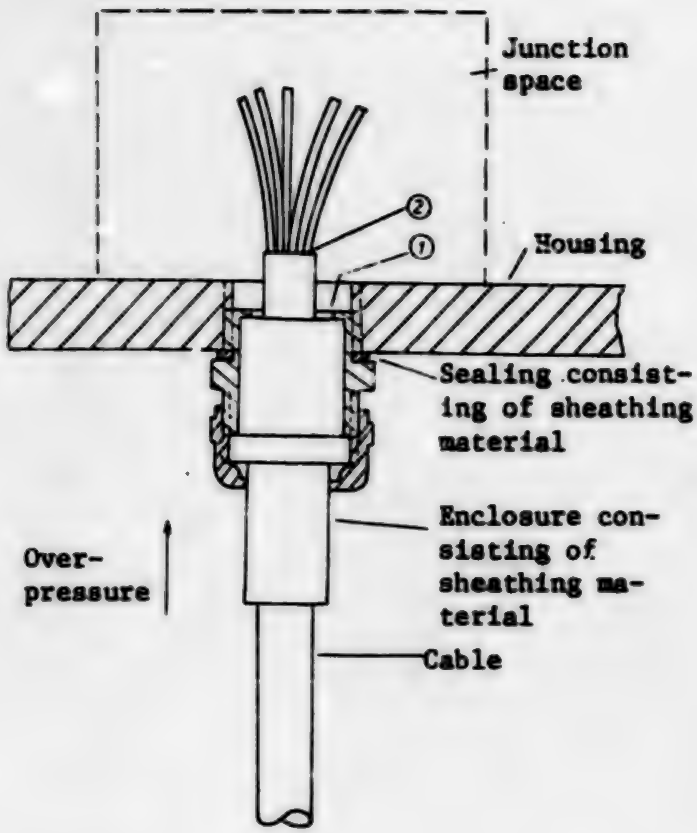
6. Request documentation.

7. Domain of application: for applications requiring high levels of safety (e.g., in nuclear power plants, subway shafts, ships, department stores and skyscrapers); for applications involving high concentrations of property value (e.g., power plants, in ship construction, electronic data processing facilities).

8. Allowable sustained temperature: 90° C; emergency operation--500 hours, 130° C, 50 hours, 160° C; short-circuit temperature--300° C.

9. Doel power plant, Belgium; Muelheim-Kaerlich power plant.

10. The ratio of the price of traditional cables to that of "Rhenohal" cables ranges depending upon the type, from 1:3 to 1:6.



Siemens

In the view of the Siemens Company the expression "fireproof cable" is unsuitable, "since it can lead to errors; it is sometimes understood to mean 'not burnable.'" Thus such a designation should only be given to mineral-insulated cable. Siemens would like its own products to be understood to be cables "having improved behavior in fire."

1. The cables are designated by the trade name Sienopyr NC. Sienopyr is the designation for cables which do not propagate flame in the event of fire and the NC denotes the fact that gases produced by fire are "noncorrosive." Some of the cables are high-voltage cables and some are communication cables.

2. There are available 2- to 4-core high-voltage cables having cross sections ranging from 1.5 mm^2 to 240 mm^2 for a nominal voltage of 1 kv and there are available communication cables having up to about 16 pairs in paired cabling with solid conductors of 0.8-mm diameter and stranded conductors of 0.5-mm^2 cross section for a maximum operating voltage of 600 v (peak voltage).

3. The electrical and mechanical properties of these cables are matched to the intended purpose. They correspond to the data established in the

appropriate VDE or IEC standards. The following properties are especially worthy of mention:

a. Fire behavior: the cables pass a special multicable fire test which is defined in VDE 0472, Section 804, Test Type C (draft proposal). They have performed outstandingly in the fire tests conducted by the Otto Graf Institute in cooperation with the Baden TUV.

b. Freedom from halides: none of the cable materials contains halogens. Thus in the event of fire the cables do not liberate corrosive gases. This is demonstrated in a special test which at the present time is performed by the authorized VDE panels.

c. Smoke development: during the fire tests the smoke density is measured optically. The smoke density observed with Sienopyr NC cables is very much less than that with traditional cables. This form of test is also in preparation by the VDE.

d. AS testing: the cables pass a special test which demonstrates that the cables also remain functionally effective even in the event of a design breakdown (AS) of a nuclear power plant.

e. Radiation stability: only those materials are used which secure that the cables are not unacceptably damaged in an operating nuclear power plant or under the radiation occurring during a breakdown.

4. The cables possess copper conductors which are either single-core or multicore. The wall thicknesses of insulation and sheathing are determined in high-voltage cables by the relevant IEC specifications. In the case of communications cables they are in accord with the VDE specifications for installation cables in industrial electronics. Communications cables have shielding consisting of Al foil or consisting of woven copper wire. The cores are twisted into pairs, the pairs into bundles and the bundles into ropes.

5. Depending upon the application either EPR mixtures or SIR mixtures or reticulated polymers are used as insulation while for the sheathing flame-resistant mixtures on a basis of reticulated polyolefin-copolymers or SIR rubbers are used.

6. Fire-resistant fittings: for the intended application (see item 7) as a rule no fittings are required.

7. The cables are provided principally for use in containment of nuclear power plants but also for situations involving high requirements with regard to fire behavior, freedom from halides, smoke development.

8. The admissible sustained operating temperature can be derived for a specific material from the VDE specification 0207. Over a short period of time the cables pass the hot-steam test prescribed for the AS testing.

9. These cables have not yet been used in external facilities.

10. The pri es will be supplied upon request.

It will be necessary to ask many more questions before we possess clear evaluating criteria for "fireproof" cables. That these are "burning" questions is shown by, among other things, the answers of the manufacturers.

8008
CSO: 3102

BIOTECHNOLOGY HELPS PULP, ENERGY INDUSTRIES

Helsinki SUOMEN KUVALEHTI in Finnish 28 Sep 79 pp 88-91

[Article by Kimmo Pietilainen: "Finland Is a Leading Country in Biotechnology, The Eighth Day of Creation"]

[Text] The price of oil is rising and there are fewer raw materials. Tradional hard technology is in difficulties.

The application of the knowledge of new biology has led to a forcefully developing branch of industry, biotechnology.

Biotechnical revolutions will be an attraction of the future. Man has learned how to create small organisms for his own investigation.

Finland has traditionally been one of the world's leading countries in the application of biological knowledge. Its opportunities in the area of biotechnology are exceptional.

Henry Ford designed his Model T cars so that they would use gas. The cars operated on alcohol, gas, and a mixture thereof. The purchaser of this automobile was able to use energy sources from the environment.

Another famous American, Al Capone, recognized the possibilities of the raw materials of his environment. While the police were looking for him, Capone used city garbage to operate distilleries for the making of whiskey from the large wheat shipments coming into Chicago.

The application of popular biological knowledge to industry has been limited to the production of alcohol and the satisfaction of household needs. The application of the properties of biotechnology, microbes, or small organisms in practice has traditionally been the most prevalent in breweries and creameries.

There was sufficient knowledge of the new biology already at the beginning of this century, but biotechnology was not yet developed. The raw materials of the chemical industry and energy sources were so cheap that no attempt was made to find alternatives for hard technology.

However, conditions have changed. There are fewer and fewer raw materials and the price of energy is increasing rapidly. Alternatives are being actively sought. And the conditions for the birth of a new technology are in existence.

There have been sufficient examples of the economic power of the new biology. Modern biotechnology was born in the 1940's. The United States began producing mold-bearing fungus on an industrial scale for the production of penicillin.

Penicillin revolutionized health care and these new industrial procedures were applied to other areas of industry, which are now undergoing a forceful development phase. The opportunities of biotechnology are only just now becoming known.

According to a certain historian the birth of a new technology is at least as important event as the domestication of animals. We are talking about the eighth day of creation.

Man has learned how to control microbes. Biology is becoming a source of wealth.

The Miracle Technology

In the large industrialized countries biotechnology is considered as the new miracle technology after microelectronics. The United States, Japan, and the Federal Republic of Germany, the leading countries in biotechnology, are making considerable investments in this new industry.

According to the current five-year plan of the Soviet Union biotechnology there will grow at a rate four times faster than any other branch of industry.

Due primarily to its pharmaceutical industry the United States makes the greatest use of biotechnology. Japan, on the other hand, has developed new possibilities. Success has been exceptional and Japan has a world monopoly on the production of various products, among other things, the structural portions of albumen, and amino acids.

Japan's new biotechnology has been developed over the last 40 years and it is supported by a large research group. The annual production of this industry amounts to 40 billion markkas or an amount equivalent to Finland's state budget. Biotechnology makes up 5 percent of Japan's gross national product.

Raw Materials Are Renewed

Biotechnology differs from traditional technology in that it is more advantageous under current conditions. Its establishment requires relatively small investments and a large amount of knowledge. The development work

requires cooperation among the sciences. The operation of an industrial plant needs microbiologists, biochemists, chemists, engineers, and mathematicians in addition to the customary personnel trained in commerce and law.

Biotechnical industrial processes are soft. They conform better to the environment than traditional hard technology, which uses large amounts of energy and produces pollution.

The potentials of hard technology have been observed to be limited in this decade. Raw materials are becoming exhausted and the environment has become critically overloaded.

Biotechnology operates on the edges of hard technology, in those areas which it is not profitable to use traditional procedures. The raw materials of biotechnology are the waste products of hard technology, pollution, or vegetable products.

Vegetables, biomass produce a full 60 kilos of cellulose per resident per day. Other chemicals also appear in large quantities, but these raw materials are still not being fully utilized.

The most important applications are the collection of raw materials from the paper industry and agriculture. The use of plants with a weaker content is still in the experimental stage with respect to energy and nourishment.

The most important applications of biotechnology are, evidently, connected with the production of energy and albumen substances. The industrialized countries are dependent on both.

The oil-producing countries are continually raising their prices. Europe, which is known for its agriculture, imports 80 percent of its animal fodder produced from albumen substances from other countries. The cultivation of its own production is inevitable and biotechnology will create the conditions for this growth.

Finland's Tradition

The new biotechnology arises out of tradition. In Japan they are sake-wine and soya sauce, among other things.

In Finland there is also a very strong traditional biotechnology, which has primarily been a part of the foodstuffs industry. These traditions have been supplemented with new procedures.

According to Prof. Tor-Magnus Enari of the State Technical Research Center Finnish traditional biotechnology is at its pinnacle.

"The quality of the domestic research and the preparedness of Finland's brewery technology is demonstrated by the fact that foreign beers have not been able to dominate the markets here.

"The brewery malt is all domestic and the malt made from Finnish barley is exported to Scotland and Japan for the production of whiskey and to the Soviet Union as a raw material for beer.

"In our country we have developed procedures in which bacteria produce albumen substances from paper plant waste products. There are two such plants, Jamsankoski and Aanekoski. They produce nearly one-fourth of Finland's need for fodder protein."

According to Enari there would be room for more such plants in our country, but the economic conditions for their construction are not favorable at this time. The price of soy has dropped and industrial proteins at this time are not competitive.

"We do, however, have sufficient undeveloped potential, whose prospects are promising."

Gasahol

Energy can be produced from biomass. Applications are being sought enthusiastically and in the United States, for example, there are approximately 500 such projects.

Biomass must be converted into a suitable form before its energy can be used efficiently. One of its forms is alcohol, methanol or ethanol.

In Finland alcohol has primarily been used for industrial purposes. Production was at its peak after World War II. In 1951 27,000 tons of alcohol was produced from the waste products of sulphite plants, thus slightly more than the amount of alcohol consumed in our country annually. Sulphite production was stopped and the production of alcohol has decreased.

In recent years alcohol has become an important substitute for gasoline. Gasahol, in which there is 10 percent alcohol, is being sold in Brazil. The process there is being based on the use of plants containing sugar such as sugar cane and manioc. This procedure is questionable since its raw materials grow on only the best farmland.

The suitability of other plants has been researched elsewhere. For example, a certain American research group is recommending pineapple since it grows on dry land and requires little irrigation.

Gasahol is also being sold in the United States, which is experiencing a gas shortage. The number of stations distributing it has increased explosively. Significant tax credits have been given for gasahol. Farmers cultivating plants suitable for the production of gasahol are being told of government support for cultivation instead of subsidies for allowing fields to lie fallow.

The energy consumption of industrialized countries is, however, so great that gasahol at least in the near future will not be of great economic significance.

In Finland there are sufficient raw materials suitable for the production of alcohol. Waste products from the paper industry and cities as well as surface peat, which is now being used for land improvement, seem to be the most dependable sources.

Agricultural surpluses are also suitable, but uncertain harvest conditions prevent the establishment of a dependable industry.

In Finland there is a project whose goal is to produce alcohol from cellulose. This production, however, has to compete for raw materials with the paper industry. At this time the application of unused cellulose waste in dumping grounds would ease the waste problem.

Also at this time the production of gasahol is not profitable from the point of view of economics or energy. The distillation costs more than it produces, but as the process is developed and the gas shortage becomes worse gasahol will become more generalized.

In Prof. Enari's opinion "under our conditions the goal of substituting 10 percent of the gasoline with alcohol seems realistic. The peak production of sulphite alcohol would not today really affect the consumption of gasoline. It seems that it would only be possible to use gasahol for essential transportation."

The development of a new industry requires effective training and modern research activity. As opposed to many other countries we already have the facilities for training. The technical colleges have study programs in the area of the biochemical industry and the biochemical departments of the universities are graduating chemists familiar with the conditions in our country.

The Otaniemi Biotechnical Laboratory will be completed at the end of November. One of the general peculiarities of research funding in Finland is that not all projects are being taken care of satisfactorily. The allocation of money for this purpose was insufficient.

Genes Are Being Combined in Finland

One of the most interesting areas of biotechnical research work is recombinant-DNA, which is also called DNA-recombination and gene manipulation. Experts in this technology are able to combine the hereditary factors or the genes of other organisms or new combinations of genes with bacteria or cells.

In Finland recombinant-DNA research is just beginning. Successful gene transfers have been made under the direction of Prof. Veikko Nurmikko in Turku, but their results have not yet been published in scientific literature.

In Helsinki there is a research group based on the joint efforts of five institutes, whose goal is to create a professional recombinant-DNA research board in Finland.

Docent Leevi Kaariainen of the Helsinki University Institute of Virology believes that domestic research projects are the only opportunity for acquiring such knowledge in Finland.

"The institutions involved in recombinant-DNA research will not accept researchers unless they are expert in the field. Our goal is to create a research board which can export the collected knowledge to foreign countries. With their assistance we will then continue to develop knowledge here at home.

"We expect that in 3 to 4 years we will be able to build some simple genes and combine them with bacteria. After that we will be able to handle more demanding projects.

"The subjects of study will, of course, be selected in accordance with the needs of our country. A typical problem at this time would, perhaps, be to clarify the structure of genes producing interferon, but this problem is still too difficult for us."

Dangers Have Been Exaggerated

Recombinant-DNA has now been studied for 6 years. A human insulin-producing bacteria constructed in the United States has been the greatest achievement in this area. "Our goal is to be able to accomplish similar projects in a couple years at the most. I believe that we are still in the forefront of this field," states Leevi Kaariainen.

Kaariainen does not want to predict the future, but other supporters of recombinant-DNA are enumerating the probable applications of this procedure. The first of these applications to be of commercial value will be the transfer of genes containing nitrogen bacteria from leguminous plants to the bacteria of other soil so that there will no longer be a need for nitrogen fertilizer in grain fields.

Some researchers believe that the depositing of genes capable of combining plants in suitable bacteria will create an unlimited source of energy. The bacteria would divide water into hydrogen and oxygen. Hydrogen is an applicable fuel and the whole process would work with energy from the sun.

The most adventurous medical doctors believe that some day they will be able to cure hereditary diseases by replacing the elements disturbing the functions of an organ with new genes.

On even a more demanding scale metallurgists are dreaming of concentrating ores with bacteria manufactured in proportions large enough for this purpose.

And in general it is being said that the really significant potentials for application have not even yet been invented.

In Finland the dangers of biotechnology have received an exceptional amount of attention. The releases of yeast dust at the Aanikoski Plant demonstrate that carelessly managed security measures or unexpected dangers can result in a catastrophe.

Industrial health problems are, however, normal to industry. Experience indicates that they can be managed. The incidents at Aanekoski are probably the initial difficulties of a new branch of industry.

There is another danger factor, which has aroused considerable attention, connected with biotechnology and primarily its research phase. The opponents of recombinant-DNA are suspicious that genes deposited in foreign microbes can create an organism which has exceptionally good life potential. The diseases resulting from it could cause an ecological catastrophe.

Recent research has indicated that the danger is much smaller than anticipated.

For example, it was imagined that human genes deposited in bacteria could result in particularly distructive forms of life. Experiments have shown that the chances of survival for these organisms are exceptionally poor.

In addition to this, the experiments are conducted with bacteria which cannot survive in annormal environment. A certain recently developed test bacteria requires for its survival diaminopimelic acid, which probably does not appear anywhere else except in pine cones.

In Docent Kaariainen's opinion these issues have been handled correctly in Finland.

In Finland security regulations concerning recombinant-DNA have been developed. "Experiments are subject to permission and they are tied in with legislation concerning communicable diseases. And the law in Finland is well observed and strict."

In Leevi Kaariainen's opinion "We have progressed along the right path. Now that the conditions for experiments have been put in order, we can now go on to the issue itself."

The present situation in biotechnology is in many respects reminiscent of the position of electronics in the beginning of the 1950's. The application of knowledge is only beginning.and it presupposes extensive research work.

Electronics developed at a rapid rate since it had definite military applications. The military potential of biotechnology is great. However, in 1969 the United States and the Soviet Union concluded an agreement which prohibits the use and development of biological weapons.

This agreement dates back to a time when the potentials of recombinant-DNA were not realized. In spite of this, more than 60 countries have failed to ratify the agreement. Time will show whether this agreement will be interpreted in accordance with the needs of weaponry technology.

Biological weapons are relatively inexpensive and they do not require expensive missile systems. Therefore, they could entice tyrants entertaining grand illusions to use it as a means of threat.

The Potential of Our Biotechnology

The application of biotechnology requires a considerable amount of knowledge. Not all applications are within everyone's reach.

The most important strategic weapons of the economic struggle between states are in spite of everything else knowledge and skill. With them it is also possible to develop biotechnology, whose potential in Finland is exceptional. In relationship to our population we have a large amount of biomass, which can be applied as an industrial raw material.

Our domestic markets limit development. They are small and are not capable of supporting such an industry by themselves. This new technology must be directed toward exports.

We have very good examples of successfully managed export projects in our country. Suomen Sokeri [Finnish Sugar] has with a definite goal in mind developed new industrial procedures for the export market. The most famous of these is xylitol or the manufacturing of sugar from birch trees.

On a smaller scale, for example, the ergotalcoids produced by the Leiras Company by means of microbiotechnology have displaced the chemicals previously isolated from ergot. This product is primarily for export.

Such old industrial institutions as Alko and Valio have participated in research work, but their efforts have been concentrated on the support of technology for their own use.

In Tor-Magnus Enari's opinion bolder approaches could be taken in this respect in our country.

"Our enzyme industry seems to have good development potential. The enzymes themselves as well as the industrial processes used in manufacturing them represent a commodity suitable for export." Enzymes are biological molecules, which accelerate chemical reactions without the high temperature conditions required by the traditional catalysts.

The development of enzyme technology began at the end of the 1950's when Alko built a mold-enzyme production line. At this time the State Technical Research Center is studying cellulose-dispersing enzymes, which could, for

example, be used for the production of gasahol.

Another noteworthy project of the State Technical Research Center, in which Valio also participated, produced a milk whey containing a lactose-dispersing enzyme. Its industrial use is being studied at the experimental plant in Koria. This product will improve the nutritional properties of milk. For example, adult Africans and Asians are not able to use milk products as a form of nutrition, but milk treated with this enzyme is suitable for them also.

On the other hand, the dispersion of milk whey improves the properties of industrial products. Ice cream does not crystallize as easily when milk whey is dispersed.

In Tor-Magnus Enari's opinion the development of biotechnology is a matter of national importance. "It is not worthwhile for us to compete with the international monopolies since we are able to maintain our position by concentrating our resources.

"The initiation of research projects involves risks. The state should support such activities without prejudice and not allow failures to be borne by the enterprise itself.

"Indeed, the state takes its share of the success."

10576
CSO: 3107

GOVERNMENT'S R&D POLICIES CRITICIZED

Paris FRANCE NOUVELLE in French 6 Oct 79 pp 18, 20, 21

[Article by Guy Hermier: "To Defend Science in its Diversity..."]

[Text] On 25 September, Guy Hermier and a delegation of the PCF spent a day at Orsay, met numerous scientific researchers and discussed with them the current situation and the future of the national scientific potential. At the end of this meeting a declaration was made public. We publish it below.

The attacks against the CNRS (National Center of Scientific Research) are not an isolated fact. They are part of the plan of an organized offensive against researchers and scientific research. The threats which are weighing upon the INRA (National Institute of Agronomic Research), the CEA (Center for Atomic Studies), the INSERM (National Institute of Health and Medical Research), the IBSID (Institute of Research on Metallurgy), the dismantling of the CNES (National Center of Space Research) and of the IRIA (Institute of Research on Information Processing and Automation), the decisions of the Council of Ministers of 1 August on research and of 15 August on university careers, the scandalous campaigns orchestrated this summer, at the highest level, against science and researchers are just so many proofs that the government is conducting in this matter a deliberate and coherent policy.

To impose it, the government is trying to isolate the scientific community. It claims that the reforms in progress would only have the objective of making scientific research more useful to France and Frenchmen.

But the truth is completely different.

From 1958 to 1978, there was a relatively sustained research effort which manifested itself in large programs dealing notably with aeronautics, information systems, nuclear research and space research.

Since then, especially since 1974, the government has been following a completely different policy. This one shows itself in the constant lessening of the share of the GNP set aside for public and university

research. The diminution of the number of patents applied for and the reduction of scientific job offers illustrate this tendency. The decision to abandon some active sectors and the abandonment of the large programs of the preceding period are the consequences of this. Thus it was with the French nuclear series, with our space activity or with the dismantling of the CII (expansion unknown).

This policy imposes greater and greater reliance on foreign technologies. It turns its back on national independence.

Thus some real problems are born which Mr Aigrain uses as a pretext for imposing what he calls a true "turning point" in the research policy.

The goal of this is clear: to adapt our research structures to obtain a concentration of means upon some large industrial projects conceived exclusively in terms of the positions of French multinational companies in international competition.

Ruling by Guarantee

This orientation extends the dismantling and abandonment of entire sectors of our scientific potential.

It leads to a growing integration of French scientific research into a system dominated by the industrial groups of the U. S., Japan and the FRG. It is obvious that such a policy brings about at the same time a weakening of the French economy and a serious blow at the national scientific potential.

It would also lead to drawing a line through the place of France in basic research. It must be said forcefully, selective financing, the desire to orient research in terms of the perspectives of profits of the multinational companies, what is called "ruling by guarantee," all this is incompatible with the appropriate rhythms and the exigencies of acquisition of results of basic research. No serious politician, no scientist can claim the contrary.

This policy is serious for the staffs. The instability of the position, the precariousness of regulations, the blocking of careers and positions, the absence of prospects can only aggravate the unemployment which is already massive among young scientists. Here again, the consequences on scientific activity itself are evident, since this process does not permit the renewal of the teams and leads to the impossibility of transmitting technical, practical experience, indispensable at all levels of scientific experimentation.

Naturally, such a reactionary policy needs to abolish the original democratic structures that the desire for independence and decades of struggles for progress allowed to be instituted in our country.

Researchers are excluded from choices bearing upon the definition of the great axes of research and the staffs are eliminated from the management structures of the systems of the CNRS: decidedly this new scientific policy is injurious for the staffs, for research, for the nation.

The retrograde character of this policy finds its illustration in the campaign orchestrated this summer against the CNRS, researchers and science.

Mrs Saunier-Seite scorns science while claiming to justify it when she speaks of research in these terms: "demagogic pulverization of resources into men," "bureaucratization of science," "administrative expansion and waste." As for Mr Aigrain, he euphemizes in writing "that the potential of French research must adapt itself to current socio-economic exigencies" while he only has in view austerity for research and profit exigencies of the multinational companies.

Nothing will have been lacking in this campaign to denigrate science, scientists and research, not even the intervention in extremis of the president of the republic or the NOUVEL OBSERVATEUR which writes about the waste: "If, despite the topheaviness of its administration and its finicky inspections, the CNRS does not manage to avoid waste, it must be concluded that, past a certain point, any soviet-style bureaucracy ends up by itself engendering the calamities which it is its mission to render impossible.

When the leaders of a country lay the blame with so much scorn and cynicism upon those who are at the heart of scientific effort and on the leading edge of innovation, they discredit themselves. But the most serious point is that they put the future of the country in peril.

No Fatalism

This is why we communists combat this policy and call upon researchers and all scientists not to allow such aggression to continue.

The French Communist Party reiterates its confidence in the whole of the scientific community. We reject the idea of any sort of fatalism which would lead France inexorably into decline.

Scientists, like all workers, know that it is not by destroying our capacities of production, by demoralizing those who create, by laying the blame on those who invent, that France will come out of the crisis. As for us communists, in the same manner that we fight against the closing of factories and against the break-up of our industry, we are fighting to assure the necessarily interdependent advancement of the struggles on the /entire scientific front/. [in italics]

We must preserve and develop our scientific potential. Whether it's a matter of developing knowledge or of putting into operation the results of research, French scientists have proved the eminent utility of their work.

If such is our policy, it is because our combat for science is rooted in an accepted tradition and in the strategy determined by the 23d Congress of the French Communist Party.

The development of knowledge and its mass diffusion are trump-cards indispensable for the growing mastery of nature and society. So we want and we fight for the progress of humanity. Democracy, self-rule imply the free soaring of scientific thought in every domain. People can measure what a gap separates the reductionist conceptions of the government with regard to science, and the conceptions of the PCF.

I say it again, there is no social progress, no soaring of democracy, of national independence, without development of science and scientific research.

The combat for science is thus also inseparable from the struggles of the working class in all its aspects, for the social mastery of the processes of production, for the knowledge of human and social relationships, for the development of culture and to lighten the misery of men at work.

The extent of the converging interests, of the hopes and struggles of the scientists and of the working class give the entire measure of the retreats which it is impossible to force upon the government and the struggles which are undertaken are indeed necessary.

Not To Mask the Diverging Interests

Naturally, numerous are those among you who are saying, "We want to struggle united, we must unite."

We understand this question and share their concern, but we do not wish to deceive scientific workers.

How can one agree with the socialist Gilles Martinet when he writes, as if in echo to the government's campaign: "Why sink important sums into sectors where we expect no more significant progress?"

Or again with Alain Touraine who writes in the socialist newspaper LE MATIN DE PARIS: "Can our society, which is facing great and lasting economic difficulties, devote important resources to research of which much does not seem to have immediate or easily-identifiable economic effects?"

How can one defend national independence, a job at the CEA and call for a stop to nuclear research in France?

How can one, really, claim to defend scientific research confronted by the appetites of the multinational companies when one did everything possible, at the decisive moment, in the autumn of 1977, to eliminate them from the field of nationalizations!

All this requires no commentary.

To hide these divergences would be to harm the effectiveness of the struggles. Nothing can better allow surmounting them than your action and your unity, you the scientists, to defend your trade, your work. This fundamental unity is the shortest road to making the government retreat and to defending research.

The Debate

We are the aggressor in this struggle. The support that we bring to the French scientific community is not circumstantial. It will be verified on the occasion of numerous initiatives, throughout France, around several great objectives of struggle.

1--To preserve and develop the national scientific potential and to assure an equilibrium between basic research, applied research and developmental research. The widest possible diversity of fields of investigation of reality must be permitted. This diversification will contribute to favor a new growth and improvement of working and living conditions.

Not a laboratory closed, not a job deleted, not a program abandoned will fail to receive the appropriate reply at the local, regional or national level.

2--France must authorize an appropriate, sufficient national effort, which is the condition of a profitable reinforcement of international scientific cooperation.

Naturally, we will forcefully pose all these questions during the budgetary debate in Parliament.

3--We want to launch a national campaign for the revaluation and general redevelopment of scientific employment in France. This concerns researchers, engineers, technicians and the masses of the staffs, notably without protective regulations, who cooperate in scientific activity. This also concerns the defense of numerous centers of French industrial research which have been dismantled at an increased rate since 1974 or which are being removed outside of national territory.

The question of the occupation of scientist is a decisive stake for the defense of science.

4--To consolidate and enlarge the existing democratic structures.

For us, the progress of research is inseparable from that of democracy, indeed from the development of internal administration in this sector. A larger part of the activities of research must be carried out in the public sector in the broad sense, and the whole organized in a coherent manner.

The expression of a new need, of a new question, would have infinitely more chance of becoming an object of scientific study if the structures of research were democratized and decentralized.

We say, finally, that the relationships between the needs of the national collectivity and the scientific community must be the object of a vast democratic debate to define the priority needs of the nation. They can only find a solution through the participation in this effort of the scientists themselves.

To get recognition, discussion and support of these objectives, the PCF is going to channel its efforts in two directions. First of all, in the image of what we have just done at Orsay, we are going to organize a campaign of explanation, of consultation, of action, in all the centers where research is going on. It will take the form of delegations, of visits, of debates during which we will frequently call for the opinion and contributions of scientific researchers.

A report of the results of this campaign will be made at the beginning of 1980 during a national initiative.

We intend thereby to contribute to this great national question, which research is, being the object of a wide debate all over the country. We will act in this direction during the budgetary debate and we will continue to act so that this question will be the object of a debate in the National Assembly.

Yes, it is possible to stop the government's campaign against scientific research. It is necessary, for science, for the researchers, for the working class, thus for the nation.

9508
CSO: 3102

GOALS OF 1980 R&D BUDGET OUTLINED

Paris AFP SCIENCES in French 11 Oct 79 pp 1-3

[Text] Paris--Presentation of the research budget to the Commission

"In 1980 the research budget will be a transition budget between the relative stagnation of preceding years and the "regrowth" which will allow us to catch up with our main competitors." In these terms Mr Pierre Aigrain, State Secretary for Research presented to the Commission for Cultural, Family and Social Affairs the package proposed by the government for his department next year. The Council of Ministers of last 1 August, explained Mr Aligrain, has indeed planned that research should benefit for a period of 10 years from a percentage of the gross domestic product which would aline France with countries of comparable size, i.e., West German and Japan.

Discussing in detail the 1980 budget project before the parlamentarians, Mr Aigrain indicated that the first priority of the adopted program concerns space with an increase of 17 percent of program authorizations. The objective is to liberate France from all foreign dependence in the field of applied satellites, especially with the launching of the rocket Ariane. Others follow: oceanographic research, energy, natural resources and life sciences with a particular effort for the benefit of INRA (National Institute of Agrarian Research. Reorganized this institute is destined to play a role as a prime mover for French agriculture and agro-food industry.

The recorder for the commission's opinion, Mr Pasty, however, noted "a certain lag" between the budgetary proposals and the specific orientations of August 1979. Will it really be possible for France to catch up particularly with West Germany and Japan?

From the same perspective, Mr Jean-Pierre Chevenement who is also the special recorder of the Finance Commission intervened to underline the growing gap (according to him) between the research budgets of the three countries considered. The 1980 research budget, he thinks, is not a resources budget, it is still falling behind: the increase for research credits is 12.7 percent compared to 14.3 percent for the overall budget. Lastly Mr Chevenement advocated a "contractual commitment" for the development of research and deplored the paucity of credits for fundamental research.

In his reply Mr Aigrain emphasized the transitional character of the next budget which must not be seen as the budget of the first year in the 10-year program. "The accumulated lag cannot be eliminated in 1 year" he said. However the budget is indeed a growth budget in so far as the progression rate (12.2 percent) remains higher than the increase of the gross domestic product in 1979."

Mr Aigrain then stressed the following points:

--One should not dwell unduly on the existance or nonexistence of priority action programs in the eighth plan as these actions cover only a part of the research effort in any case.

--Research development in engineering schools is hampered essentially by the small size of institutions (less than a maximum of 1,000 students in France compared to 8-10,000 in Japan and the United States. Two solutions may be explored: a better coordination between engineering schools and universities or the association of some schools in a federative structure.

--If research expenses of private enterprises in France appear definitely inferior to those of other industrialized countries, the cause, in part, is statistics since they often include national defense among research in the public sector. Disregarding the National Defense sector, the effort of French enterprises in relation to public research expenses is not so poor as one might think.

--France effectively takes out less patents than others, Japan for instance. In that field one comes up against a certain reluctance of French engineers to formulate patents. It is nonetheless true that the French balance-sheet of license exchanges is positive while Japan must buy much more patents than it sells.

--Credits included in the 1980 budget project are only a portion of the credits granted to DOM-TOM (Overseas Departments and Territories), ORSTOM (Bureau of Overseas Scientific and Technical Research) has also to be taken into consideration.

--The future of INREM (National Institute of Research in Materia Economy) and of IRSID (Research Institute on Iron Metalurgy) is the subject today of studies which should be concluded in the near future.

8696
CSO: 3102

MINISTRY'S OF INDUSTRY DRAFT 1980 BUDGET PRESENTED

Paris AFP SCIENCES in French 18 Oct 79 p 6

[Text] Paris--Ministry of Industry 1980 draft budget. Presented last 11 October, the draft for the Ministry of Industry budget will come before the National Assembly for discussion on 5 November next.

The budget of the State Secretariat for Research will be discussed next 24 October.

Here is the distribution of funds destined for industrial research, innovation and technology (payment credits of the Ministry of Industry for 1980, 11.984 MF, program authorizations 5077.28 MF).

The amount of PC [payment credits] assigned to industrial research, innovation and technology for 1980 comes to.............3511.22 MF

The total amount of program authorizations comes to.....2313.62 MF

These funds are distributed thus:

	A.P.	C.P.
Research of AEC (Atomic Energy Commission)	472,70 MF	1.378,00 MF
Space Research (National Center for Space Studies)	1.157,68 MF	1.370,18 MF
Oceanographic research (National Center for Exploitation of the Oceans)	164,93 MF	231,92 MF
Technology, innovation	464,01 MF	300,49 MF
Schools of Mining Research	39,13 MF	104,34 MF
Computer research	5,90 MF	53,97 MF
Coal research	-	40,00 MF
Chemical research	8,65 MF	26,25 MF
Scientific and technical information	0,51 MF	6,05 MF
Total	2.313,62 MF	3.511,22 MF

This total does not take into account:

	A.P.	C.P.
The research portion of BRGM (Bureau of Geological and Mining Exploration) which is listed in the chapter of natural resources policy	30,66 MF	28,60 MF
The research portion in the field of applied solar energy which is listed in the chapter of Energy policy	75,17 MF	58.10 MF

8696
CSO: 3102

ELECTRONICS FIRMS FINANCE INCREASED R&D, COMPETITION

Paris L'USINE NOUVELLE in French 27 Sep 79 pp 78-79

[Text] SICOB 1979 will probably not be considered the annual fair for only foreign data processing; after all, once does not constitute a habit. The strong presence of Americans, Germans, and Japanese has indeed shown that, if the market is a promoter, foreigners have already invested heavily. But, the announcement of Saint-Gobain-Pont-a-Mousson's capital investment in CII-Honeywell-Bull (by taking shares of CGE--20 percent--in the Company of Bull Machines, CII-HB's major shareholder to the price of 255.7 millions of francs) gives rise to a great hope: that of having finally found a solid financial solution to assure the growth of a great national data-processing pole. An analysis of the reasons why CII-HB sought a new shareholder and why SGPM took the place occupied by CGE (Companie generale d'electricite) shows that this hope is not in vain. "It is important that the shareholders be able to follow the economic needs of our society, while showing that they do not oppose our policies," states Jean-Pierre Brule, president-director general of CII-HB. It is thus clear: CGE no longer corresponds to the definition of a perfect shareholder. In fact, a conflict of interests arose between the two companies: both are developing along the same data-processing-related and office machines lines, in other words, they are competing with each other

The computer industry today goes far beyond the limits of constructing computers. It encompasses not only the peripherals, but is approaching new markets including those of telematics, office and individual data-processing equipment (see table).

(1) (en milliards de francs)

	1978	1982
(2) Copie-duplication	7,3	10,4
(3) Autocommutateurs privés	3,8	4,8
(4) Editions de textes	1,1	4,8
(5) Microfilms	1,2	3,6
(6) Télécopieurs	0,15	0,5
Total	13,5	24,1

(7) *Avec 177 MF en 1978 (1,3 % du marché européen), la France est quasiment absente du marché.*

Table 1. Business Machines: the market will double by 1982.

Key:
1. (in billions of francs)
2. Copiers-duplicators
3. Private autocommunications
4. Text editing
5. Microfilms
6. Telecopiers
7. With 177 millions of francs in 1978 (1.3% of the European market), France is practically absent from the market.

Can CII-HB hope to assure its future by limiting its activity to medium and large computers? Certainly not, according to Pierre Lepicard, assistant director general of CII-HB. The lines along which the group has developed are clearly evident in recent agreements and acquisitions: small business computers (takeover by RE], specialist in micro-computers), office machines (acquired by an American license for working with texts), computer-assisted conception (CII-HB participates in the development of graphic terminals programmed by CISI), finally the development of plans for using magnetic cards incorporating components (CII-HB acquired the patent for the bank card Innovatron).

Next 5 Years Will Be Decisive

But, in order to continue the first operations, the company above all needs financing in order to be in a position to repurchase companies when the occasion arises. For this, shareholders who support this are needed. But, this winter the opportunity arose to take control of Olympia Werke, a German manufacturer of business machines. The occasion was ripe for getting a foothold in business machines. But CGE, in accordance with the American firm of Honeywell Information System, which holds 48 percent of the capital of CII-HB, was opposed to this, and Volkswagen took it.

Moreover, CGE refused to participate in the financial effort which implicated the 5-year plan of CII-HB. In March, CII-HB received its last share of government subsidies (3.5 billion francs in 4 years). This was another reason for CII-HB to find a new shareholder who clearly wanted to further its development.

As all computer manufacturers, CII-HB has a large need for funds, as much for research and development (1.billion francs per year) as for investments (5 to 700 million francs per year) to modernize and enlarge the means or for prefinancing the renting of computers.

If the firm just announced the first two products of its new range, it must follow its efforts for unifying the different series of computers put out by Honeywell or by the old CII, just as IBM attacks its competitors by reducing its prices.

For its part, Saint-Gobain-Pont-a-Mousson has good reasons to become interested in data processing. Doesn't it have to reorganize the group activities toward sectors of solid growth?

A first step has been taken with the creation of Eurotechinique, a subsidiary of both SGPM and National Semiconductors, which manufactures electronic components. This penetration continues today by leaps and bounds. SGPM's intention is to take a "more significant share" of the capital of Bull Machines.

Will the government sell a part of its shares to allow SGPM to hold the minority of blocking power. Or will we witness an OPA (takeover bid) in the direction of other shareholders which hold 60 percent of the capital of CMB?

In contrast, one question seems already answered: SGPM will engage itself with the public powers to repurchase eventually the share of Honeywell Information System in the capital of CII-HB, in the event that Honeywell will want to drop out of data-processing.

SGPM's contribution will go beyond the simple financial domain (the yearly investments capacity of the group reached 2 billion francs). It has, in fact, the intention of pushing the data-processing company by all of its industrial and human means and to engage itself in not developing any activity concurrent to that of CII-HB.

It is understandable why Jean-Piere Brule wishes to "welcome" this new shareholder. Less understood is why CGE is giving up its shares... The Ambroise Roux group has for 4 years, in fact, prepared the way for a large diversification in business machines and computer-related activities, mainly to strengthen the activities of CIT Alcatel: Sintra-Transac is developing itself in the military field and in computer-related activities; Satas and SHM-Adrex have specialized in office equipment and postal equipment. Especially, the complementary nature of the activities of CGE (telephone) and CII-HB (data processing) appear to have logically favorized the constitution of a French pole of...telematics. One occasion that CGE could not seize. The next years threaten to be crucial for CII-HB. To the point where some are asking themselves whether the public powers will no longer give them assistance in the form of subsidies (the financial strength of SGPM should suffice), but by orders.

Table 2. The most promising market: mini-computers. Evolution of world computer markets since 1975 and forecasts up to 1983 (millions of dollars)

		1975	1978	1980	1983
(1)	Ordinateurs universels	10 600	14 300	17 800	20 800
(2)	Progression annuelle		12 %	12 %	5 %
(3)	Mini-ordinateurs	1 180	3 065	4 845	10 300
(2)	Progression annuelle	.	37 %	26 %	29 %
(4)	Petits ordinateurs de gestion	400	1 725	2 440	3 850
(2)	Progression annuelle		62 %	20 %	16 %

(5) *Les gros ordinateurs representent encore le marché le plus important; mais leur part relative diminue : 87 % en 1975, 71 % en 1980, 59 % en 1983. Pour les mini-ordinateurs, on prévoit un taux de progression annuel de près de 30 % d'ici à 1980. Quant aux terminaux, le marché mondial devrait croitre lui aussi à rythme élevé (15 % par an) pour atteindre 6 500 millions de dollars à l'hoziron 1983.*

(Source : International Data Corporation)

Key:
1. General-purpose
2. Yearly progression
3. Mini-computers
4. Small business computers
5. Large computers still represent [illegible] largest market; but their relative part is decreasing: 87% in 1975, 71% in 1980, 59% in 1983. For the mini-computers, the rate of yearly progression is predicted as being close to 30% by 1980. The world market of terminals should also grow at a high rate (15% per year) to attain 6,500 millions of dollars by the end of 1983.

9128
CSO: 3102

GROWTH OF MINISTRY OF INDUSTRY EXPENSES OUTLINED

Paris SEMAINE DE L'ENERGIE in French 25 Oct 79 p 3

[Text] The Ministry of Industry budget for 1980 amounts to a total of 5.07 GF (billions of francs) in program authorizations (PA) and 11.98 GF in payment credits (PC) for the heading Research.

In relation to the 1979 budget the growth percentage of credits is +19.98 percent for PA and 11.41 percent for PC.

Within the package:

--ordinary expenses amount to 7.62 GF (of which 2.79 for research), that is an increase of +754.26 MF (+10.97 percent) earmarked for the creation of 129 jobs.

--equipment expenses are given 5.07 GF in PA (of which 4.02 GF for research) and 4.35 in PC (of which 3.67 GF for research) which represents a growth rate of +19.98 percent for PA and +12.17 percent for PC.

8696
CSO: 3102

ENERGY CONSUMPTION, CONSERVATION IN CONSTRUCTION

Rome FONTI DI ENERGIA ALTERNATIVE in Italian No 2, Mar/Apr 79 pp 53-58

[Article by M. Mancia, Institute of Architecture, Department of Physics, University of Reggio Calabria: "Possibility of Savings in Energy Consumption for Housing"]

[Text] 1. Premise

It is not easy to estimate the total energy consumption for the construction and completion of buildings since it is necessary to consider and analyze consumption pertaining to the manufacture of the individual component construction materials, consumption for transportation to construction sites, and finally consumption for on-site work.

Studies and research were conducted in various countries on these requirements and the unit values determined differ among each other because they are correlated with the housing construction standards that are now similar in the various countries considered and, besides, the overall requirements likewise differ.

For the case of Italy, the following values were indicated in the 1974 energy balance sheet (drafted by the Ministry of Industry):

Energy consumption (from primary and secondary sources)

(a) For construction materials	62,991	Tcal
	(263,680)	(TJ)
(b) For housing	576	Tcal
	(2,411)	(TJ)
Total	63,567	Tcal
	(266,901)	(TJ)

This annual energy consumption in overall terms is equivalent to about 7 percent of total consumption for energy uses in Italy.

These data however are not very accurate. As a matter of fact, for example, under the item of "construction materials" (a) does not include energy consumption for the entire annual output of cement, whereas in reality only 58 percent of that output are actually destined for housing construction (42 percent of the cement output is used in nonhousing projects, in public works, and in agriculture).

The above-indicated consumption figures however do not include energy uses for the manufacture of glass and ceramics which however are very modest since (for example) only 2.7 percent of the energy consumption for glass can be credited to "glass for housing construction" and only 30 percent of the energy for ceramics can be credited against so-called material used in housing construction projects.

Besides, still looking at the data given above, they do not include energy uses for the production of structural steel, for plastic materials, and for various other materials which today are widely used in housing construction.

Finally, these computations generally do not consider the fuel consumption pertaining to the transportation of materials during the various production phases.

This technical report is intended to go more deeply into the study and estimates of the basic elements for the calculation of energy needs in housing construction and to outline suitable architectural and construction system solutions as well as any possible technological improvements particularly in the production of cement and in the production of structural steel which could considerably reduce these requirements. The reduction in the output consumption could come to 25 percent for cement and 35 percent for steel. By the year 2000, both of these production efforts could reveal energy savings on the order of 45 percent (according to Ford Foundation estimates).

2. Energy Needs for Housing

Various authors prepared more or less in-depth analyses on the energy demand for the manufacture and transportation of housing construction materials and for the construction of the buildings themselves; these studies furnish figures, in terms of unit quantities, for the individual components and in terms of surface or volume units for the buildings.

These studies however arrive at results that often disagree among themselves in various ways, primarily due to the diversity of criteria used in the evaluations of the unit quantities of the individual components and because of the diversity of housing standards adopted as regards the surface and volume units.

In particular, since the values for the housing standards necessarily differ among each other, they are being determined for each particular standard, whereas those pertaining to the individual construction materials are analyzed with relation to the respective, technologically updated production system (as is generally the case in the industralized countries) which is why--especially in the case of the latter--there should not be any appreciable differences if the analyses were performed with similar criteria.

Looking at the situation from a methodological viewpoint concerning the analysis criteria, drafted by the IFIAS (International Federation of Institutions for Advanced Study--Stockholm, Sweden), two types of analysis are indicated, that is:

PER (Process Energy Requirement),

GER (Gross Energy Requirement).

The PER analysis involves the energy quantity--from primary sources and in terms of enthalpy--required in order to make a material (or a manufactured article) available in a manner limited to the production technology alone, dispensing with any prior processes (such as, for example, in the case of steel, its production process) and the energy quantities required to extract, work, and transport the necessary materials during the various phases.

The GER analysis on the other hand includes the sum of all energy quantities required, during the various phases and under each heading, in order to make the material available and ready for use in housing construction.

The determination of the PER value is certainly the simpler one here if for no reason other than data collection and the availability of sources from which they can be obtained.

The latter however are anything but abundant, predictable, and exhaustive party because the importance of expressing the required energy in quantitative terms for a given production effort materializes only when, due to the restrictions in the sale of petroleum products by the Arab countries, the rapid depletion of the usual primary sources was the subject of greater attention.

However, since the cost of any product is inevitably the sum total of all of these various prior cost items, its energy content must be evaluated with a similar criterion, that is to say, in terms of GER.

Besides, the electrical energy used must not be computed on the basis of 0.86 Mcal/kWh but on the basis of the heat volume required to produce it

through thermodynamic transformations, adding the energy requirements within the electric power plant and taking into account the transmission losses; in this way we get a more precise value (international standard) of 2.6 Mcal/kWh equal to 10.88 MJ/kWh.

To determine the above-mentioned values, various authors used data and information obtained from the public institutions of the various countries; these results are quite thorough and any possible major differences must be blamed substantially on the criterion employed in the analyses (PER criterion or GER criterion).

Energy Needs for Housing Construction in Italy

As far as the analysis of energy requirements for housing construction in Italy is concerned, the available data are only those that are contained in the BOLLETTINO STATISTICO of the Ministry of Industry, directorate-general of energy sources and basic industries (which we hereafter will refer to as BSMI [Statistical Bulletin of the Ministry of Industry]); it presents approximate data supplied by the various production sectors as well as those reported in the energy balance sheet of that same ministry (hereafter referred to as BEMI [Energy Balance Sheet of Ministry of Industry]) which makes reference to the BSMI source with nonhomogeneous and noncorrelated magnitudes.

In the BSMI we find the quantities of some base materials produced (although not in homogeneous units and not subdivided by types of uses) as well as those of the various fuels and of the electrical energy used in production. The BEMI on the other hand reports the total quantities of the various fuels and the electrical energy utilized for energy uses in the following activities sectors: agriculture and fishing, industries, services, household uses, and nonenergy uses.

It is impossible to obtain more precise and more complete data from other organizations or agencies.

The CIP (Interministerial Price Committee), which presumably should have verified and accurate analytical data on the production costs of materials at interrelated prices (which as a matter of fact include materials essential for housing construction, such as cement, bricks, and steel) does not make available the data it has, considering them "restricted."

The producing outfits, both public and private, are against the idea of supplying or permitting the procurement of data on these points. However, the category associations generally do not have these data and feel that, considering the current state of affairs, the various outfits only have very rough and limited data, possibly and only for consumption of fuels in terms of product quantities.

The above-mentioned BSMI therefore is not much use in putting together computations on energy consumption volumes for the various types of construction materials.

As a matter of fact, for example, in the case of bricks, the BSMI reports energy utilization not in relation to the total weight of the output but rather in relation to the number of assorted standard items and in terms of floor surfaces (!). For ceramics and stoneware, for lime, for plaster, and for glass, on the other hand, the BSMI indicates only the energy consumption and not the quantities produced. For raw steel produced, we find some data on quantities produced for housing construction but the energy consumption relates only to the entire steel industry sector. Finally, the BSMI, concerning cement used in housing construction, indicates only production energy consumption and production quantities (in terms of weight), broken down in terms of klinker and ground cement. This is why we can assign a specific energy content value only for cement as the ratio between the sum of quantities of the various fuels and of energy and the total quantity of material produced. (The sum of quantities of the various fuels and of electric energy for the corresponding energy values is equal to $1.888.10^{11}$ MJ.)

Table 1 shows the values for the specific energy content thus obtained and those values are compared with the others that—for the case of cement and other materials—are provided by some authors who worked them up on the basis of official statistical data and in keeping with the PER or GER methodologies adopted.

Table I. Values of specific energy content assigned to some materials used for housing construction (in MJ/mg).

Materiali 1)	Metodi adottati per Autori 2)			
	GER	PER	PER	BSMI
	Sroczynski e Szpilewicz	Gartner e Smith	Chapman	1974
Cemento 3)	8.070	7.250	7.920	4.928
Calce 4)	7.000			
Gesso 5)	.2.360	3.200		
Laterizi 6)	2.670	2.500	1.800	
Acciaio per c.a. 7)	54.540	47.250	47.250	
Acciaio lamin. 8)	58.900			
Vetro edilizia 9)	38.630		22.500	
Isol.miner. 10)	20.460			
Prod. ceram. 11)	21.340			

e--

Key: 1--materials; 2--methods adopted by authors; 3--cement; 4--lime; 5--plaster; 6--bricks; 7--steel for reinforced concrete; 8--steel plate; 9--glass for housing construction; 10--mineral insulation; 11--ceramics products; e--and.

The significant difference between the value assigned by Chapman to cement in the form of PER (admitted to be quite predictable and used by various authors) and the one obtained from the BSMI shows how the latter are not useful as regards fuel and electric energy uses, so that one must presume that those pertaining to the quantities produced are useful .

For the purpose of the investigation, which is confined to bringing out the order of magnitude of energy utilization for housing construction, we are going to adopt unit values assigned to the materials by Sroczynsky and Szpilewicz because they are available for a broad range, following computation in the form of GER, after the collection of data and official research by public organizations specifically pertaining to energy sources and their utilization.

Materials Used in Housing Construction

As far as the quantities of the various housing materials used in Italy are concerned, we can quote below (in the absence of data obtainable from the ministry's bulletins) some of the essential data collected by the category associations or from other information sources consulted.

(A) Cement

According to data furnished by UNICEM, the following quantities of cement were used in Italy in 1974:

	Mt
For residential housing construction	7.6
For miscellaneous housing construction projects	7.03
For industrial reconstruction	6.5
For public works	8.17
For miscellaneous uses	6.5
Total	35.80

However, since the item "public works" includes the construction of schools, hospitals, and other buildings, etc., and since the item "reconstruction" includes maintenance and remodeling, not taking into account the share under the heading of "miscelleneous uses," one can estimate that the annual quantities of cement for housing (in 1974) were on the order of 21.0 Mt [million tons]. This is a rather predictable value also when compared to similar investigations conducted in France and Germany, that is to say, countries similar to Italy in terms of housing standards.

(B) Lime and Plaster

According to data collected by ASSOCEMENTO [Cement Association], the following quantities were used in 1974:

	Mt
Lime	2.32
Plaster	0.8
	2.40

Taking into account the (minimal) shares not going into housing construction, we can figure on a total utilization--for housing construction--of 2.30 Mt, considered in the form of lime (which has an energy content by far greater than plaster).

(C) Steel

FINSIDER [Iron and Steel Finance Corporation] collected the following production data (for 1974):

	Mt
Iron rods	2.20
Steel strips	0.9
Section steel for construction	0.7
Black pipes	0.4
Zinc-coated pipes	0.3
Steel rods	0.3
Total	4.8

In a specific technical report (Armani), the total quantity is sometimes given at 4.88 Mt and sometimes 5.0 Mt.

However, considering that this figure includes a share for the production of steel for boilers and various mechanical parts, as well as the aluminum intended (to some extent) for the production of window frames, etc., the production of steel for housing construction is something like 4.50 Mt per year.

(D) Glass

The Glass Producing Industries Association does not have data on the quantities of glass used in housing construction.

But the ISTAT [General Statistics Institute] bulletin gives a total of 21,948 t, which should be considered absolutely too small. According

to other investigations, the figure for glass production for housing construction is on the order of 0.065 Mt for about 7.8-8.0 Mm^2 [million square meters], in other words, much less than what we have in the countries of Central and Northern Europe where the use of double and triple glass panes is however widespread.

(E) Bricks

According to the Housing Industries Association, about 20 Mt bricks were produced in 1974 and the entire output must be considered to have been used in housing construction.

(F) Ceramics

On the basis of data furnished by Assopiastrelle, the 1974 output was on the order of 0.4 Mt.

The approximation in these data is due primarily to the small information furnished by the extremely widely scattered user sectors but, for the purpose of the investigation here, we can consider them acceptable in terms of quantities assigned to each material, as shown in Table 2, with the respective specific and total energy content.

Table II. Materials used in 1974 in Italy for housing construction and corresponding GER value.

Materiali 1)	2) *Quantità* *Mt*	3) *Valori* *Tcal*	*GER* *TJ*
Acciaio div. 4)	*4,50*	*60.200*	*252.000*
Cemento 5)	*21,00*	*40.485*	*169.470*
Calce e gesso 6)	*2,30*	*3.846*	*16.100*
Laterizi 7)	*20,00*	*12.900*	*54.000*
Ceramiche 8)	*0,40*	*2.040*	*8.536*
Vetro 9)	*0,065*	*600*	*2.511*
Div rsi 10)		*9.078*	*38.000*
		129.449	*540.617*

Key: 1--materials; 2--quantities; 3--values; 4--miscellaneous steel; 5--cement; 6--lime and plaster; 7--bricks; 8--ceramics; 9--glass; 10--miscellaneous.

The energy need for housing construction therefore can be based on the above figures for the materials indicated there. But to the total energy

need for housing we must add about 7 percent in order to allow for all of the other materials which, although they involve modest quantities and percentages, are nevertheless used in certain finishing operations, on top of the main materials listed above. We must also add the volume of energy spent during the phases between the manufacture of the materials (producing industry) and the completion of building construction as such (transportation, various work phases, energy consumed at the construction site, etc.); this additional energy need may be estimated at something like 35 percent of the total quantity of materials used.

Sroczynski and Szpilewicz assign 72.5 percent to the production of materials out of the total volume of energy used in housing construction; [illegible] percent go for transportation needed for building construction; and [illegible] percent are involved in the construction process as such.

For the year 1974, the BEMI lists energy uses for construction materials, for miscelleneous fuels and electrical energy, totalling $63 \cdot 10^9$ Mcal. ($264 \cdot 10^9$MJ); for the "housing" item (in other words, the actual housing construction process) they list electric energy to the extent of only $0.567 \cdot 10^9$ Mcal. ($266.5 \cdot 10^9$MJ); this gives us a total of about $63.6 \cdot 10^9$ Mcal ($266.5 \cdot 10^9$ MJ), which cannot be added to those under the glass and ceramics heading, with $26.7 \cdot 10^9$ Mcal ($112 \cdot 10^9$ MJ) because of the modest amount of these products used in housing.

3. Specific Volume or Surface Energy

The quantities of energy used for the production of materials used in construction projects, on the basis of the figures in Table 1, are quite different, as indicated in the total values given in Table 2, and here we must add the energy for the building construction phase and material transportation which, as we said, amounts to 35 percent.

The total value divided by the usable volume and surface built in 1974 should give us the average quantity of energy required per volume or surface unit of building.

The ISTAT bulletin gives the number and the cubic volume of buildings, the number of housing units, the number of rooms, utility rooms, and empty spaces, as a total.

In view of the diversity of values assigned to room surfaces and secondary spaces, the total surface value is rather uncertain. We could therefore take into account only the cubic meters of buildings which in 1974 were finished to the extent of 91.437 Mm^3 of residential buildings and 46.791 Mm^3 of nonresidential buildings, giving us a total of 138,228 Mm^3.

As revealed by research conducted with reference to the quantities of materials employed in housing, and by admission of the ISTAT itself, this value is about 40 percent too small because of some neglect in data

transmission and waste in construction as such. As a matter of fact, related to the total energy value, this gives us a specific figure which cannot even be compared to those that, though they are different, are given in the analyses conducted by the various authors.

As a matter of fact, the specific volume or surface energy value of housing construction is heavily influenced by the standards adopted, both plane-volumetric and construction process standards, that is. An order of magnitude of the specific surface energy value, which can in some way be transposed, due to standard similarities, to construction efforts in Italy, may be derived from the studies prepared by Scroczynski and Szpilewicz where GER values are assigned in the range of 4,960 MJ/m^2 for a building executed in the monolithic style, with reinforced cement, with four or five stories, all the way to 5,250 MJ/m^2 for a similar building however with 17 floors, in other words, an increase of only 6 percent, whereas for the same number of floors in a building with a steel structure, using perimetral and internal elements, with monolithic style using reinforced cement, we get a figure of 8,920 MJ/m^2, in other words, an increase of about 80 percent compared to the 5-story building and about 70 percent compared to a building of the same height, executed in the monolithic style.

4. Final Considerations and Conclusions

We can derive the following indications from the investigation, apart from the rigor of the evaluations assigned.

(A) Total Energy Quantity for Housing

The total energy quantity used, as shown in Table 2, for the production of materials used in housing construction in 1974, related to data from the BEMI for that same year, constitutes 32 percent of the value assigned to the entire industrial sector given as $0.405 \cdot 10^6$ Tcal ($1.7 \cdot 10^6$ TJ), while the quantity for fuels and energy, for the transportation and construction phases, which, figured at around 35 percent of the quantity used for the production of materials, would come to $0.45 \cdot 10^5$ TJ and would be attributed to the surface sector, thus constituting about 23 percent of the value which we get from the BEMI as having been used in that sector.

The percentage figure for the total quantity of the industrial sector is partly rather high because the computation of housing materials was based on the GER value and ther fore also includes the transportation functions pertaining to production whereas, in the quantities indicated in the BEMI for the various heading within the industrial sector, they are not included; this by the way is not surprising, considering that, among the total quantity of energy used for the entire international output of various principal materials, steel and cement account for 68 percent.

(B) Possible Reductions in Specific Requirements

The energy requirement for materials used in housing construction—involving primarily the use of temperature at average values and, therefore, fossil fuel, can be reduced due to a reduction of specific requirements in the production of cement and steel, respectively, by 20 percent and 35 percent, by the year 1985 and by about 45 percent for both of them by the year 2000, with reference to the current values, as a result of technological improvements, which however otherwise might be extended to prefabrication, thus holding down the rate of steel utilization through more sophisticated designs and building heights, extending to housing construction the organizational techniques and the local production facilities adopted for big highway construction projects.

(C) Energy Savings Due to Insulation

According to the BEMI, energy utilization for domestic uses in 1974 came to about $0.282 \cdot 10^6$ T cal ($1.18 \cdot 10^6$ Tcal, including $0.17 \cdot 10^6$ Tcal ($0.71 \cdot 10^6$ TJ), as indicated in Table 2 for housing construction, involving kerosene, gas-oil, fuel-oil, used for the heating of buildings, amounting to 62 percent of the sector, with about 39 percent of the total annual demand and about 14 percent of the energy content of primary petroleum sources. This energy use, in contrast to the energy intended for construction, is a heavy burden to be considered to be, so to speak, inert, because it has no production purpose and therefore should be held down as much as possible.

This objective can be pursued, in new construction projects, in significant amounts and through a rather ridiculously small increase in the energy quantities required to build structures. We might consider, as a matter of fact, that the transmission coefficient of a perimetral wall, made of prefabricated cement, can be brought up to a value of 3.6 $KJ/m^2h°C$ which is optimum and certainly 2.1 $KJ/m^2h°C$ with thicknesses, respectively, of 25 and 50 mm of good insulation, whose effect on the energy requirement value, for the production of 1 square meter of surface of the entire prefabricated panel, is only 0.4 and 0.8 percent, respectively.

Besides, the window transmission coefficient can be reduced to 60 percent, in other words, 9.2 $kJ/m^2h°C$ as compared to the one we get from a single window, that is to say, using two windows [storm windows] with an increase in the energy requirement pertaining to one square meter of wall amounting to 1.2 percent, considering a rate of 20 percent of transparent surface and 1.65 percent with a rate of 25 percent of perimetral vertical surfaces.

The suitability of the energy investment seems quite obvious here because, after it has been made, it promotes a tremendously greater energy savings without any further expense.

At most, one could consider a reduction in the construction energy requirement if we take into account that a major reduction in the building heat loss involves a proportional reduction in steel required for the heating system and if subsequent energy loads, which is not at all modest, figuring that an average reduction of 50 percent of the transmission coefficient, on the basis of a temperatere difference of 25°C between inside and outside, would bring about an increase in the construction energy requirements not in excess of 65 percent of the total energy requirement reduction which results from the smaller radiator surface required, alone.

Right now, the economic variations in the construction do not reveal similar proportions and those given above in energy terms however tend to be approximated to the rise in energy costs (particularly energy from fossil fuels) which will assume a tremendous significance with respect to the parameters that make up the cost of producing the materials employed in significant quantities in housing production, which, as we showed in Table 1, has a very high energy rate.

(D) Rate of Fuel Use in Housing

The energy required for housing construction is basically taken from fossil fuel employed for the production of materials and for their transportation which is inevitable in the current state of the art; improvements of course will make it possible to reduce the required quantities.

For building heating we are also presently using fossil fuels but it is possible significantly to hold down the requirements by improving the insulation of buildings (particularly those which take up almost the entire requirements here) and by using solar energy.

The resultant fuel consumption reduction will not only bring a benefit in terms of foreign exchange but will relieve the tight demand situation thus indirectly contributing to holding down the construction costs.

In the current state of affairs, the investment required for the insulation of buildings or for the construction of a plant for the utilization of solar energy cannot be paid off over an economically suitable span of time at current energy and money costs.

It is furthermore useless to expect that they will in the future be compensated for by energy savings because an increase in energy will result in parallel increases in material costs.

At the same time, it is not so much the increase in the cost of fossil fuels but their shortage which, in a short time already (starting with the eighties) will raise major economic problems for Italy and this is why it would be wise to provide incentives and subsidies for investments that will make it possible to hold fossil fuel consumption down.

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SPECIFICATIONS OF BRESCIA'S MUNICIPAL HEATING SYSTEM

Rome FONTI DI ENERGIA ALTERNATIVE in Italian No 1, Jan/ 79 p 62

[Unattributed article: "Brescia--First Italian Example of Large-Scale Long-Distance Heating"]

[Text] Centralized heating of large urban population centers (long-distance heating), often provided by plants for combined electric energy and heat generation, is now rather widespread abroad, especially in Europe.

In the USSR, there are at present 1,000 centralized heating plants serving 800 cities, 472 in Germany, 400 in Denmark, not to mention France, Poland, Austria, Yugoslavia, and finally Spain. Most of those plants are supplied by heat from their own power plant. In the public sector, little or nothing is being done in spite of the recommendations of the EEC and the steps which other European countries have been taking for quite some time to provide an incentive for and to regulate this industry.

The only Italian experience in urban long-distance heating, supplied with recovered waste heat, is the one in Brescia.

A heat distribution plant, constructed and managed by the local city agency, has been operating for 7 years in this city in Lombardy and the system is gradually being extended to the entire, most heavily populated section of the city.

Right now, 430 buildings (out of the 1,350 buildings earmarked in the final version of the project) are being supplied with long-distance heat to the tune of 5.5 million m^3 (out of 16 millions). In addition, 40 km of double underground pipelines have been laid out of the 70 km planned. The heat is supplied by a combined thermoelectric power plant which began operating in October and which will be doubled within 2 years. It first operated as a standard thermal power plant and it now stores heat and is operated as a combined power plant.

So far, 21 billion lire have been invested here with the help of the standard finance market at standard, nonpreferred interest rates; that amount of money will gradually be paid back with the proceeds from service operations without in the slightest restricting the other activities of the community. The total investment will come to 52 billions.

Thus, the jointly owned boilers will gradually be disappearing in Brescia and, along with them, the smog in the atmosphere, as well as the troubles connected with their management due to fuel shortages and due to the places that had to be converted for such use. Tiny heat exchangers will gradually be substituted in the basements of houses. A counter will measure the heat taken out and the amount will be reported to the user with a customary bill.

Table 1 below shows the most significant data for the plant put up by the ASM [Municipal Service Association?] of Brescia within the dimensions provided for in the final version of the project.

Table 1. Technical-Economic Data on the Long-Distance Heating Plant of the City of Brescia.

	Final Project,	1978 (October)
Power plant		
Volume supplied	16 million m^3	5.5
Hourly peak demand	300 Gcal	110 Gcal
2 boilers of 13.5 Gcal/hr		in operation
1 boiler of 55 Gcal/hr		in operation
1 boiler of 70 Gcal/hr	To be ordered during 1981	
1 boiler of 55 Gcal/hr	To be ordered in 1997	
1 combined group for recovery of 30 Mw electrical and 75 Gcal/hr thermal (combined power plant		in operation
1 combined recovery group equal to the preceding one	To be installed shortly	
Network		
Double-pipeline kilometers	70	40
Buildings connected	1,350	410
Personnel force		
Technical	62	26
Administrative	6	6

Investments		
Network (billions)	27	10
Power plant (billions)	25	11
Annual output		
Heat (Tcal)	660	167
Electricity (GWh)	210	30

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ASPECTS OF NEW BRESCIAN POWER GENERATION SYSTEM EXAMINED

Rome RINASCITA in Italian 2 Nov 79 p 27

[Article by Giuseppe Berruti, vice president of the Brescian Municipal Services Firm]

[Text] Brescia, October--The recent official inauguration of the "combined" thermoelectrical power plant, managed by the Brescian Municipal Services Firm [ASMB], has again proposed--in one of its searches for "alternative" sources--the subject of practicable solutions in the area of active conservation of energy and, at the same time, that of the role of public endeavors by local organizations with regard to the same objective. I use the term "active conservation" of energy, because that is more applicable in our case and, at any rate, does not give rise to possible misunderstandings, such as exist in the current concept of "saving energy."

Let us begin with a brief synthesis of the essential data which characterize the Brescian installation in order, subsequently, to give the necessary space to the answers to a question frequently asked: Why such a solution has been possible in Brescia and whether it would be repeatable elsewhere, that is, in other Italian urban situations. The "combination," which is the logical basis of the installation, consists of the simultaneous production of electrical power and of hot water piped to the point of its end use. It is well-known that many hundreds of cities in Europe are now heated remotely (over 800 in the Soviet Union alone and more than 300 in the FRG). The Brescian installation, the first and up to now--at least in qualitative and dimensional terms--the only one in Italy, has until now been putting out 30 megawatts of electrical power and 75 giga calories of thermal energy every hour. When the installation is completed, the principal network of remote-controlled heating will comprise 70 kilometers of double underground piping and will serve 45 percent of the consumers' needs (the overall population is now 215,000 residents). The power plant is made up of two twin groups (the second is under construction) composed of three large boilers and, afterwards, by other groups for the combined generation of electrical power and heat, using diesel generators. In contrast to conventional thermoelectrical power plants, the heat derived from the cooling of the condenser is not dispersed but, rather, is recovered to provide heat for end users--to the extent I have indicated. As a result, the yield of the ASMB installation,

again with respect to conventional thermoelectrical power plants, jumps from an average of 35 percent to more than 90 percent. The facility can be furnished with various gaseous or solid fuels or with a mixture of both. When completed, the installation will permit a saving of about 60,000 tons of diesel fuel per year. Moreover, it should be pointed out that a single installation--replacing hundreds of family and condominium-type boilers--being equipped with special filtering devices, reduces the smog from the heating to almost zero.

Finally, it must be emphasized that the financing of the overall investment is made possible by resorting to the financial market, as is done in any industrial undertaking: it is interesting to note the substantial participation of IMI [Italian Credit Institute] as well the interest shown in this regard by the European Investment Bank. It is of particular interest to note that the construction of this facility does absolutely not interfere with the policy of investments in public projects carried out by the municipal administration. And it is not of little note that the financing is covered, during the time foreseen for the return of the investment, by receipts from the consumers without which--at least up to now--there has been and is no contribution or concession made by the state; this is in contrast to what happens in other European countries.

What are the factors which helped make the Brescia accomplishment possible, and what are the possibilities of its being repeated elsewhere?

These factors are basically of two types: the technically structural and the political. Under the first category it should be pointed out that the ASMB is a multiservice municipalized firm. In fact, the energy department manages the services of the production and distribution of electrical power, heat and water, of the distribution of methane gas (to the extent that 80 percent of the consumption is served by the municipal network of gas and remote heating), of public lighting and of the traffic-light systems. Specifically, the volume of electrical power produced by the various sources (conventional thermal power plants, combination plants and hydroelectrical) in 1978 came to 439 million kwh, of which only 16.5 percent was produced by the ENEL [National Electric Power Agency] complex. The centralized management of the energy services offers advantages in several areas: organizational, technical (we need to think only of the role of the operator with numerous skills employed in the integrated energy services). and the area of costs, leading to a well-defined balance. Nor is it forgotten that the contextual management of the urban transportation and sanitation services contributes, at least in part, to the rationalization of the municipal services. But in particular, centralized management of the energy sources by a local public firm, permitting a horizontal integration of the sources and recipients, plays a complementary and fundamental role in the basic system developed for large-scale production and transportation and for international energy exchanges, a basic system which ranks on the national level.

Nor does it follow that a basic condition is constituted elsewhere by the transformation or aggregation of public firms of local organizations in terms of "energy firms" with integrated services.

To be sure, the Brescian solution is not the only possible solution or alternative. However, that solution appears technically realizable over the reasonably short term. Moreover, it should be added that many other cities of northcentral Italy, having a higher population density, would be able to achieve even more advanced results, particularly in the area of the time required to realize a return on the investment. And it is in fact positive knowledge that other municipalized firms--from Milan to Mantua, in Pavia and Emilia, in Veneto and in Trentino-Alto Adige--have already begun to engage in similar solutions or are in the act of studying similar projects. Such a process of expansion of solutions for the active conservation of energy can be achieved all the more rapidly if--within the framework of energy plans on the national and regional level--a concrete policy of incentives and promotion is established from both an institutional and financial aspect.

However, returning to the Brescian achievement, we must speak of another consideration of a fundamentally political nature. In fact, in addition to the use of advanced technology and the organizational and technical capabilities of the services, another decisive factor has contributed to making the achievement possible: the unified will of the political forces of the entire constitutional spectrum, in the Municipal Council as well as in the administrative committee of the Brescian firm, a unified and responsible will which has permeated the entire project. Together with this, the organized and knowledgeable participation of the city, which experienced all the decisive phases of the process through hundreds of meetings culminating in the firm's "Production Conference," played a part; furthermore, all the democratic political forces and all the economic and union forces met in an open, logical discussion and jointly came up with the design. It is not rethorical to assert that without that unified political will, without that intense participation, the planning and realization of the program would certainly have been much more complicated and difficult.

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COMMERCIAL VIABILITY OF SOLAR TECHNOLOGIES EXAMINED

Rome FONTI DI ENERGIA ALTERNATIVE in Italian No 2, Mar/Apr 79 pp 3-6

[Article by Sergio Vacca, director of the Institute of Energy-Sources Economics (IEFE), L. Bocconi University, Milan: "Outlines of an Industrialization Policy in the Field of Solar Energy"]

[Text] 1. Examination of the possibilities for development of technologies for the capture and utilization of solar energy in our country must be founded on careful evaluation of all the manifold actions to be undertaken not only in the technological field but also in the industrial, legal, commercial and organizational-distributional fields--actions that fall into a great many categories, private and public, institutional and noninstitutional.

One must indeed be well aware of the fact that incomplete analyses could lead to optimistic conclusions (especially in the field of low-temperature thermal applications) that would certainly be well-received by the supporters of solar energy but would be dangerous for the very future of a solar energy market, inasmuch as they could lead to premature commercial initiatives which, as they subsequently failed, would have considerable negative effects on future demand.

Hence it is first of all a matter of establishing the conditions under which a given reliable and proven solar technology could attempt commercial take-off with significant chances of success. This is a basic problem, but a different one from evaluation of the potential contribution of the various individual solar technologies to the energy balance-sheet. In other words, in order to be capable of helping to fill the energy needs, a reliable and proven energy technology must be able to be commercializable; but this depends on factors that may be entirely independent of its reliability.

In this regard, it may be noted that commercialization of a technology such as the one in question could be made quite difficult by the presence of administrative restrictions, such as political control of the prices of the conventional energy sources, for example. In this case, on the assumption that a technology is judged to be suitable from a general economic and also social

point of view, the problem of its commercialization inevitably call for economic policy action for the purpose of removing the restriction entirely or in part so as to permit the advantageousness of the technology in question to be realized.

Economic policy action could likewise be useful in removing a number of difficulties that arise in the commercialization takeoff phase, when it is considered advisable--in the general economic sphere--to accelerate the diffusion of the same technology.

These brief considerations are sufficient to demonstrate the fact that when, in a country like ours, there are valid reasons in favor of the diffusion of solar energy, such diffusion is not a problem that can be solved on the level of private economic convenience; it is one that must also be posed in a political-economic framework.

2. There is also the fact that a solar technology's contribution depends on the success or failure of the commercialization of each of the available technologies and on the specific time of market penetration. In other words, the times of energy fertility can be different from one technology to another, and will probably be slower in the already commercializable low-temperature technology, but quite a bit faster in the technologies of thermodynamic and photovoltaic conversion, which, moreover, are still rather far from the phase of initial market penetration. This is so because the potential use is different: in the case of low-temperature technology, one generally has to do with relatively fragmented demand and small unit powers, while in the other two cases, the potential use is relatively concentrated and characterized by larger unit powers.

All this is sufficient to draw attention to the fact that an economic or industrial policy aimed at promoting the commercialization of the solar technologies will inevitably have to a differentiated one in the two abovementioned cases, at least as regards what has been said so far.

3. In the case of the low-temperature thermal applications--for which the technology of the components, such as the panels, is mature enough and can be taken as a datum--it is important above all to evaluate the supply capacity accurately--that is, the capacity of the producers and installers to:

(a) operate in the market offering a product meeting the customer's specific requirements--that is, a product capable of being adapted to different situations, with the backup of working know-how that has to be acquired, inasmuch as it is not an a-priori condition (which means that the product has to be flexible).

The requisite of product flexibility is essential in particular for the environmental heating market segment (more than for the solar water-heating segment), because building-construction patterns are highly diversified today, and in many cases are incapable of accepting, without adaptation, the stock components available for solar heating.

(b) of organizing massive distribution of low-temperature devices in order to reach rapidly a level of production equal to or higher than the critical mass. This organizational-distributional and promotional capacity should not be conceived of as a natural and ordinary adding-up of the number of systems installed, not even in the most favorable case, in which one considers the distribution of systems as already optimized.

This aspect is of the highest importance, both for the impact of large-scale component production on costs and because all the problems of organization, management and control of heliothermic systems placed (or placeable) on the market take a quantum leap in complexity when one goes from small-scale local and experimental distribution to vast distribution throughout the national territory.

(c) to collaborate in the management and control of these systems--for example, through programming of maintenance--so as to be able not only to take action in the first distribution phase with possible improvements, but also to incorporate the results of experience into succeeding systems.

In summary, among the conditions necessary for the success of low-temperature solar technology must be included a consistent effort not only, and not so much, in technological innovation (component development) as, above all, in the development of capacities that are largely downstream from the technology and that require, on the part of the supply sector, the solution of considerable problems, organizational ones especially.

Among the products of the low-temperature technologies, the solar water-heaters are the ones destined to spread before the others, probably initiating (and this is very important) a pulling effect on the other solar technologies. This is an effect due not only to the "acculturation" of the consumer but also to the push by the supply sector--that is, to the readying of a capacity for large-scale production of panels, which, with some marginal modifications made, are needed for other applications also.

Nevertheless, it is unthinkable that this could happen by "spontaneous" generation of supply and demand. Ad-hoc action, necessarily articulated to take account of the specific requirements (not only of the low-temperature technologies but also of the other ones), is required on the part of the public decision-makers.

Such requirements for public support and action are not limited to overcoming the obstacle of high costs in the initial phase--that is, they are not limited to a mere "cost accounting" calculation by the ultimate user (as analyzed in the IEFE report presented by Professor Panati), but extend to all the obstacles that can inhibit the spontaneous diffusion of solar devices, even the simplest ones.

What are the principal obstacles in question?

A careful examination carried out in the IEFE by a group composed of operators has made it possible to pinpoint the necessity of public intervention in the following directions:

(a) to create, in the most suitable ways and time periods, a control organization capable of approving the prototypes of solar components and certifying their functioning in accordance with unified standards whose definition should be completed as soon as possible. The advantage of such certification (which must be binding, and is not to be confused with certification of any commercial stamp of quality eventually put out by "consortiums" of manufacturers) is obvious both on the level of consumer protection and on the level of "protection" of the supply sector from products of poor quality or from market confusion which would depress demand itself;

(b) to create a coherent system of incentive. What is meant is a determinant instrument, one that should be prepared rapidly but should be carefully designed so as to avoid setting perverse mechanisms in motion and producing counterintuitive distorting effects.

The IEFE is carrying out an evaluation of the various a-priori approaches possible, many of which have already been adopted in various forms in several foreign countries. In particular, the analysis should furnish informational support for deciding whether incentive should be given mainly to the producer of components, to the installer of solar systems, to the building contractor, or to the ultimate user. It is intuitively understood that the answer is different depending on the stage of maturity-reliability of the technology and depending on the phase of its commercial penetration. In a general way, what seems to be emerging is the trend in favor of giving incentive to the ultimate user (and/or the building contractor).

The existence of a form of financial incentive that so far has been largely ignored should be stressed in this context: enabling the user to avoid the added financial effort to put out the capital needed for the solar choice. One flexible formula for pursuing this objective is the introduction of financial leasing of solar devices, which would enable the user to pay for a solar installation more or less in the same flow of outlays that he would have to make if he adopted a conventional alternative, but with the advantageous difference that in the solar case, the flow would cease after a limited number of years, after which a genuine proportional gain in fuel savings would begin for the user.

The entry into this market of leasing companies possessing a considerable degree of understanding and persuasive effect vis-a-vis the producers would also have the beneficial effect, and not a secondary one, of guaranteeing to the user certain qualitative and quantitative standards agreed upon with the industry.

The expression "leasing company" is not used here in a narrow sense--that is, it does not exclude the possibility that promoters of such initiatives could

be municipalized concerns or corporations or associations of another kind; nor does it exclude the possibility that the formula could be adopted by energy-producing and selling companies, thus transforming the operation into operational leasing.

4. As regards the solar boilers market, while the series of actions outlined above could be sufficient to guarantee the greates expansion possibilities, for the building-heating market, on the other hand, one would have to proceed in another direction also: encouraging, by appropriate measures, the training of operators who would have the function of main contractor vis-a-vis the building contractor and building demand in general, capable of guaranteeing the most effective coordination of all the capacities required by solar innovation, from the design stage through the smallest details of installation.

On the other hand, the public decision-makers must initially identify and concentrate on the construction types most favorable for solarization (partial or total). The task is to solarize some part of new public buildings and to provide incentives for solarization of low-density to medium-density residential buildings that are not too large and are located in the zones of most favorable sunshine. Within this framework, the local administrations and the regional administration in particular will be able to play an extremely important role.

At the same time it should be emphasized that a rigorous policy of energy savings in buildings--a category that is always important in the overall energy balance-sheet--is definitely indispensable in solarized buildings. Even in already existing buildings, therefore, a policy to promote energy-saving should be followed, so as to favor in advance the diffusion of solar technology into existing buildings as well when the production of the solar components required for solarization of new buildings has made it possible to reduce the installation costs considerably.

It should further be said that in future, urban development and zoning plans should be thought out also in relation to energy considerations, and especially in relation to the prospects for solarization.

5. As for the thermodynamic conversion (TC) sector--that is, for production of electrical and/or mechanical energy from a solar source at high temperature--one is still far from the concerns of a commercial type that have been examined for the low-temperature sector.

Many of the methodological considerations raised above are valid for this sector also, but there are very profound differences to be stressed both as regards the type of user (mainly the electric power production industry, mechanical industry, etc) and in the degree of centralization of the energy organization required by the technology, and also in the degree of technological maturity, which is quite a bit lower than that of the low-temperature technologies.

With the exception of a few small installations (such as solar pumps for agriculture), the supply sector is still in the phase of building and testing pilot installations, which cannot yet be considered commercial prototypes.

Our country holds a position of great prestige in the solar-boiler sector--a position that should be maintained through adequate support from the public authorities, both in research and development activities (regarding not only boilers but also the mirror sector) and in rapid readying of the largest possible number of prototypes of adequate size, so as to obtain the information necessary for a subsequent commercial operation.

In any case, considerable problems would arise at the moment of commercialization. In the first place, it will be necessary to work out a strategy for optimization of the spatial placement of the power-plant modules (which would probably have peak power on the order of 10 MWe) in function of:

(a) minimization, even in the regions with most sunshine, of oscillation effects due to local dimming of the sun (maximization of the curve of probability of producible energy);

(b) integration of the energy production with energy produced by nonsolar sources, so as to meet the needs in bad-weather periods (optimization in function of the network);

(c) optimal sizing of the individual installation and therefore of the surface area required, which in turn is a function of the particular conditions of the site.

All this must serve as a premise or flywheel for a rather agressive export strategy (which must necessarily be based on reliable installations), especially for exporting to those countries in which the competitiveness of the TC systems will be achieved in shorter times and with less difficulty.

Generally speaking, this is the case with many developing countries in which two advantageous circumstances can be exploited simultaneously:

--the availability of vast sparsely inhabited areas with extremely favorable sunshine conditions;

--the greater difficulty, and therefore greater cost, of electrification with conventional sources, because of the lack of big electric-power networks and because of the unsuitability of such networks in relation to the nature of the territory and of the installations.

In this framework, solar policy cannot be viewed as unconnected with overall foreign-trade strategies vis-a-vis the developing countries. This is so also because it is often relatively simpler to sell large planned systems abroad than small subsystems. For example, it is more reasonable to aim at exporting entire irrigation systems, including solar devices also, than at exporting

isolated solar pumps. In other words, it is a matter of inserting the TC systems into the framework of an overall offering relating to energy and the territory.

Photovoltaic conversion (PC) does not for the moment present any commercialization problems; photovoltaic devices are being used today both for scientific applications and for highly specialized purposes (isolated repeaters, boe [expansion unknown], etc).

To grasp the idea that in energy terms, the situation is still very primitive from the quantitative point of view, it is sufficient to reflect that--per DOE [Department of Energy] estimates--total world production of PC cells in 1977 was equivalent to only 750 kW of peak power.

This means--to prescind from the necessity of drastic reduction of the production costs (on the order of about 90 percent of the present cost)--that the transition to significant diffusion poses enormous problems in the preparation of capacity for production of solar-grade semiconductors, at a sophisticated level as regards both process and installation.

Evaluation of the industrial policy of the PC sector cannot prescind from the fact that such growth in production capacity is closely dependent on the expansion policy of the large-scale international electronic components industry, which probably sees PC as a unique opportunity to increase its industrial and economic weight considerably.

Therefore one cannot hide the fact that development of PC will involve the strengthening of power centers and groups on a multinational level. It should also be said that such groups will tend also to take possession in advance of the markets of many developing countries in which the diffusion of PC is doubtlessly more favored than in the industrialized countries, for the same reasons as already stated with regard to thermodynamic conversion.

It is precisely in consideration of this situation, with its alarming aspects, that a vigorous commitment by Italy in this sector is considered necessary, both for developing its own technology and so as to be able to absorb foreign know-how in an understanding way in the years to come, in which the problem of transfer of technologies will become very important. All this will be possible if the development plans include considerable involvement of the national industry from this point on, with a far greater commitment on the part of the body public than is presently the case, so as to get the problem of research and development out of a pattern that is still far too academic. In this framework, the action already undertaken by the Consortium (SMIELS, SGS, Ansaldo, Montedison, Galileo, ENEL [National Electric Power Agency], CISE [Center for Information, Studies and Experiments] is particularly significant and should be kept up and encouraged.

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